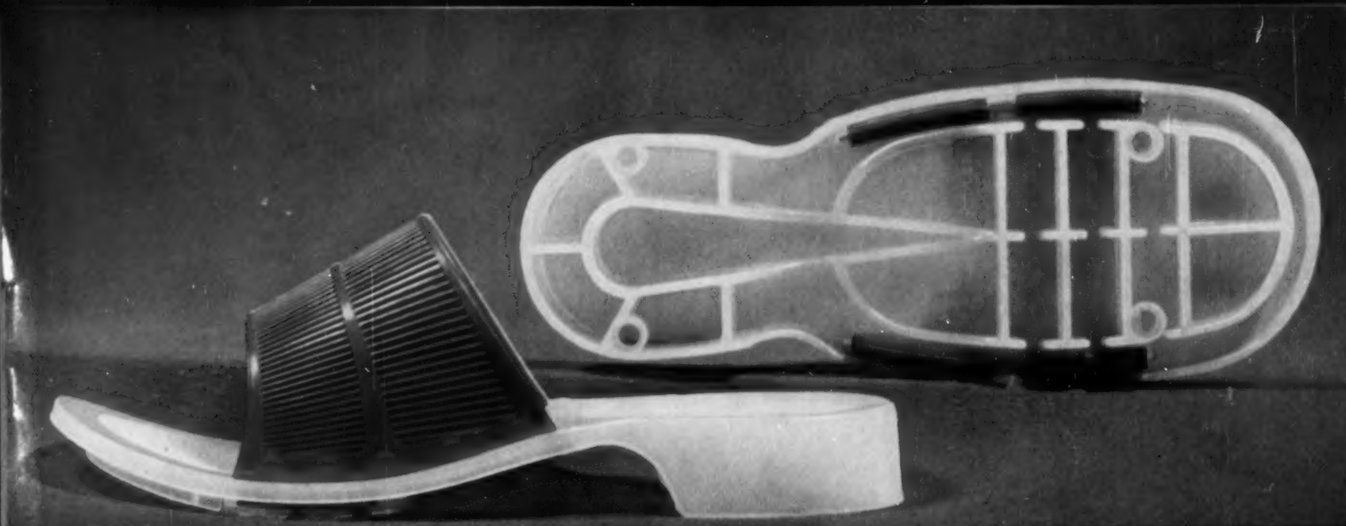
# MODERN PLASTICS

April 1956



MODERN PLASTICS*

Volume [illegible]
April 1956
Number 8

## Editorial



## The Plastiscope



## General Section



## Plastics Engineering



## Technical Section



## Departments



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*Another new development using*

# B. F. Goodrich Chemical *raw materials*


*B. F. Goodrich Chemical Company does not make this weather stripping. We manufacture only the Geon vinyl plastic.*

## New do-it-yourself idea... plastic weather stripping

WEEKEND home mechanics have a warm smile for a new line of weather stripping made from flexible Geon vinyl plastic. You simply tack or cement it on with a special adhesive that comes with each kit. It molds itself perfectly to irregularities or gaps in windows and doors, both aluminum and wood.

Here is another example of how imagination and knowledge of the properties of Geon have worked to produce a saleable new product. Geon vinyl plastic will stand the roughest weather. It won't deteriorate from cleaning solutions or salt. Its tough, abrasion-resistant surface absorbs the punishment it gets on door bottoms.

Materials based on Geon polyvinyl resins can be made rigid or flexible. They resist heat and cold, chemical action, abrasion and pounding. The high quality of Geon resins is your assurance of controlled properties. Perhaps Geon can help you with a particular design problem. For helpful information, please write Dept. DS-4, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon Polyvinyl Materials

**GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.**

**GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors**

# what can you expect to pay for custom-molded plastic parts at CHICAGO MOLDED?


Chicago Molded publishes a data-packed magazine called *Plastics Progress* to keep you up-to-date on many of the latest developments in plastics. You can get a free subscription by filling out the coupon below! Better do it now.

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You'll pay no more—often much less—for plastic parts at Chicago Molded. Here's why . . .

**CMPC engineers and designers** know how to produce the part you need in the most economical way . . . consistent with quality. You *never* get suggestions that result in a poorer product! You *do* get advice based on sound practice . . . modern methods . . . and 37 years experience in molding every type of plastic material.

Chicago Molded's unbeatable facilities include the world's foremost mold engineering facilities, as well as every type and size of press – automatic, semi-automatic, double-ram, and thermoplastic injection. With these, CMPC produces anything from the smallest to the largest plastic parts – quickly, economically, and in any quantity.

**CMPC "follow-up" service** means continuing savings for you. Our engineers keep in touch with your operations, help eliminate costly, unnecessary frills . . . suggest better molding materials . . . even help develop whole new processes to make your product better, more saleable, lower priced. *Now you know why 60% of our business comes from firms we've served for 15 years or more!*

Editorial

# Plastics for disposables

In a prosperous consumption economy the factor of disposability is an important key to continuing volume.

The tin can, the non-return bottle, the paper package, the cellophane wrapper are packaging examples of disposables. The paper cup, the paper towel, the picnic plate are non-packaging examples. In fact, most of our disposables are paper, largely because of cost but also because of the ease with which they may be made to disappear after use.

Now plastics come into the picture.

In Pittsburgh, a 14-story structure being built last winter had its surrounding scaffolding completely wrapped in polyethylene film for protection of the construction workers from the weather. The building completed, the film was stripped off and burned.

In Texas a molder is producing disposable drinking cups for coffee vending machines out of styrene alloy at a price which compares favorably with wax paper cups.

Literally hundreds of millions of formed styrene sheet plates and place mats, decorated for holiday appeal, are now sold annually. With care, they may be re-used time and again, but they are made and priced to be disposable.

The cast film storm windows, the vacuum formed plant caps, the plastic mulch for strawberries, the polyethylene greenhouse covers, the acetate one-use sun goggles are all disposable, all plastics. In packaging, of course, examples are legion, and the list is growing every day.

Not long ago plastics were so expensive that deliberate expendability, except for specialty packaging and gimcrack premiums, was not to be considered. Today the price of plastics is at a point where their superior properties in disposable merchandise makes them the first materials to be considered. And the field is fantastic in scope.

The automatic vending machine will, we predict, be responsible for the future sales of millions of pounds of plastics one-use disposable products, because plastics can out-point paper by every use test, and plastics can be made just as disposable as paper. Indeed, plastics will open up to disposables new fields, such as rainwear, in which paper could never succeed.



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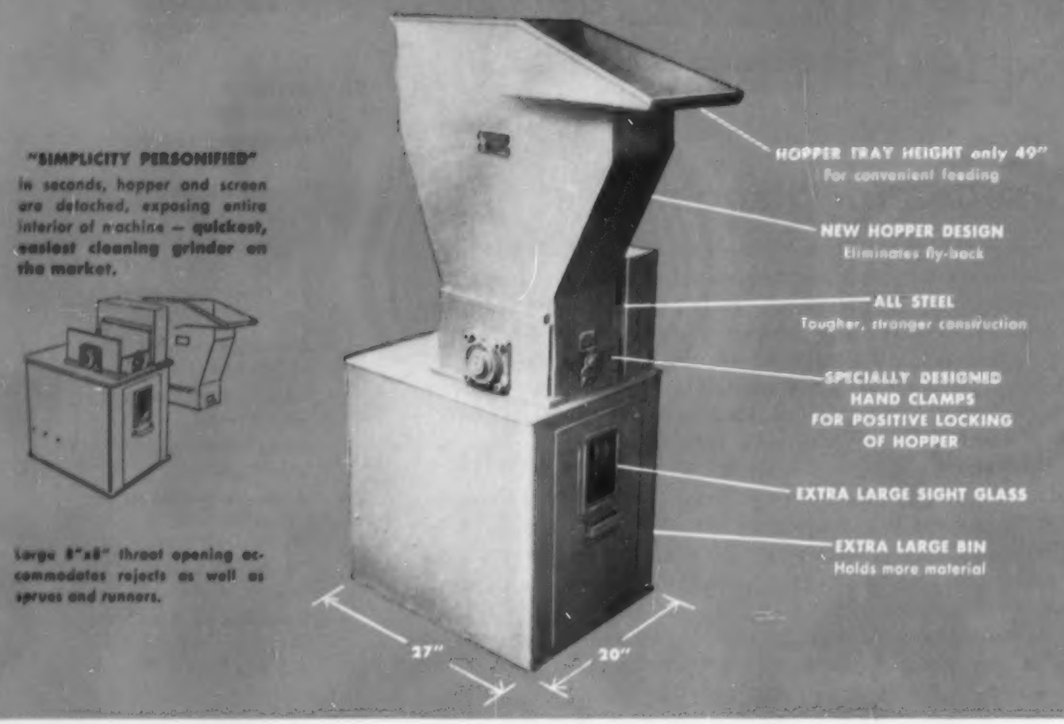
# Completely New
# Low Cost All Steel Granulator




## outperforms any beside-the-press grinder of comparable size and cost

Never before have you been able to get such outstanding performance from a grinder that costs so little. The new B&J M-100 is ideally suited for beside-the-press grinding, and, with its capacity up to 200 pounds hourly, can also be used as a batch grinder. It grinds all plastics, including elastomerics such as *polyethylene*, without fluffing. Double shear knife action readily cuts hard or soft plastics — hot and cold sprues can be fed simultaneously.

The M-100 is simpler to maintain, simpler to operate, simpler to clean than any machine on the market. Completely enclosed, it stays clean longer. The extra large sight glass shows operator when bin is filled. The extra large bin holds more, slips in and out with ease.

The M-100, first of the MARVEL LINE SERIES of all steel Ball & Jewell Grinders, is backed by the experience which has made Ball & Jewell leaders in the field for over 50 years. Standard equipment includes 1½ HP motor and starter, 2 or 3 HP optional. Casters included at no extra cost.

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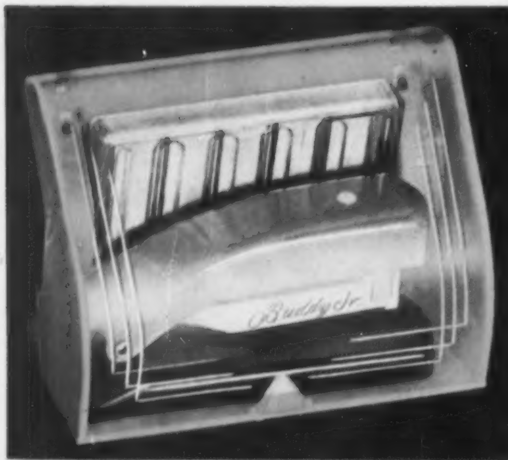
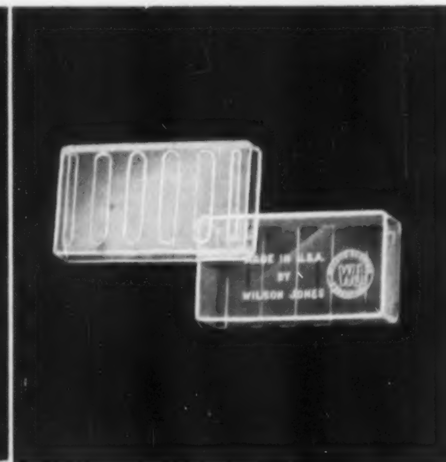
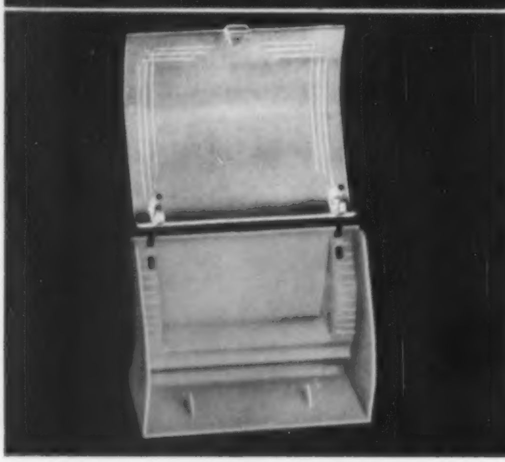
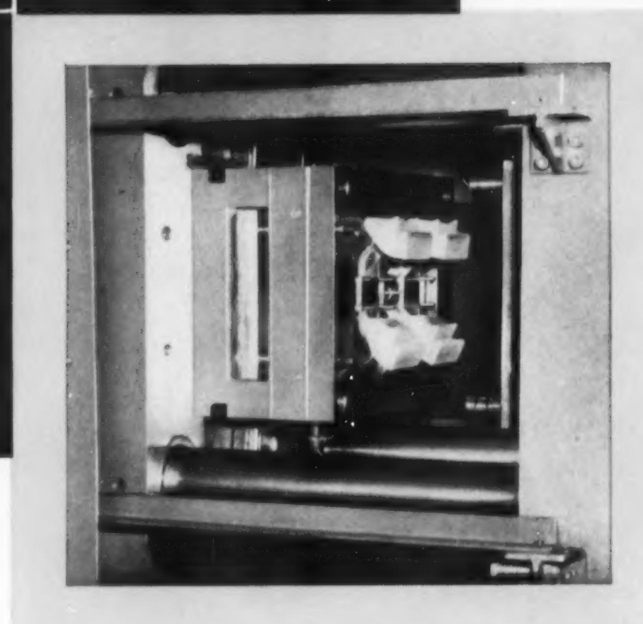
B & J HOPPER HEATER-DRYERS • PNEUMATIC MATERIAL DISCHARGE SYSTEMS
EASTERN REPRESENTATIVES—LEWIS INJECTION MOLDING MACHINES









12-cavity, hot-runner molds are used for tops and bottoms of the small box that holds extra staples. Total shots weigh 58.9 and 62.9 grams respectively. On the first 100,000-piece run, Dillon-Beck averaged 1,850 tops and 1,800 bottoms per hour. 4-cavity molds are used for the larger parts. Inset shows the "REED" injection molding machine stopped, with 4 large bottom pieces about to be ejected automatically from the die.

# Fully Automatic 175T-4/6 "REED" Molds New Stapler Package at Dillon-Beck

This smart, new polystyrene stapler package, molded by Dillon-Beck Manufacturing Co., consists of four parts. All are molded on *fully automatic* 175T-4/6 oz. Reed-Prentice injection molding machines equipped with low pressure die closing units that protect the molds during automatic cycling.

Dillon-Beck's satisfaction with their "REEDS" is typical of the easy operation and minimum maintenance that molders in nearly 1,000 plants have experienced. Every model — from the 175T-4/6 oz. to the big 600T-32 oz. size — combines rugged strength and economical molding efficiency, gives you design features such as positive mechanical locking pressure and extra-strong tie bar construction.

Now a standard on all machines, the new "REED-SPEED" heating cylinder means faster, more thorough plasticizing and lower cost. To get full information on the complete line of injection molding machines, call your Reed-Prentice Sales Engineer today.

**REED-PRENTICE**

Affiliate of PACKAGE MACHINERY COMPANY

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**ALATHON®** offers greater rigidity and impermeability for flexible squeeze bottles. They quickly snap back between squeezes and keep essences, aromas and flavors intact. "Alathon" is odorless, tasteless, non-toxic.

# 4 more examples of advanced

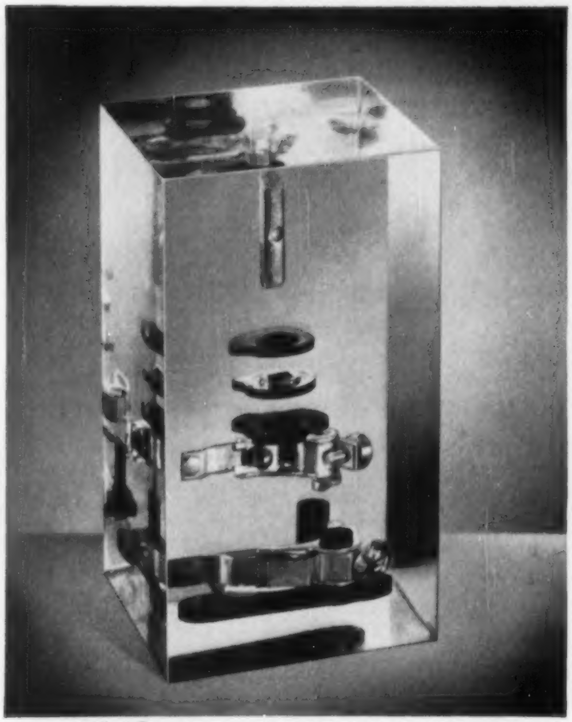
New ways are constantly being found to simplify design and reduce costs by replacing metal and other products with Du Pont engineering materials. Shown here are four typical applications made possible by imaginative use of these versatile resins.

**ALATHON®** polyethylene resin provides greater rigidity and impermeability for attractive flexible squeeze bottles. Adaptable to a wide variety of packaging uses, "Alathon" can be used in the form of film, bottles, and other containers, closures, liners for drums and multiwall bags. "Alathon" has excellent chemical and water resistance, is free from taste, odor and toxicity and its chemical properties remain unchanged with age. (Squeeze bottles of "Alathon" by Precision Extruders Division of Lamex Chemical Co., Leominster, Mass.)

**LUCITE®** acrylic resin adds beauty and durability to embedments of all types. Products embedded in clear "Lucite" are transformed into miniature sales showcases that can be handled indefinitely without growing grimy and losing their promotional value. "Lucite" also has wide application in the fields of architecture, lighting, signs and displays. It can be economically fabricated by several efficient techniques. (Embedment by Karv Art Products Mfg. Co., Camden, New Jersey.)

**ZYTEL®** nylon resin makes an economical, lightweight shower head that will not corrode or plug up. Products molded from "Zytel" feature toughness, abrasion resistance, form stability, strength in thin sections, lightness in weight and chemical resistance. (Shower head manufactured by Nylon-Maid Inc., Glendora, California. Parts by Rainbow Plastics, El Monte, California.)

**TEFLON®** tetrafluoroethylene resin is the seating material used on the "Double-Seal" ball valve. Because it is inert to virtually every commercially employed chemical or solvent, "Teflon" enables the valve to handle fluids and gases even at extreme temperatures. This chemical inertness allows the incorporation of "Teflon" in designs where formerly the best available material was unsuitable. ("Teflon" processed by Crane Packing Co., Chicago, and Fluorocarbon Products, Inc., Division of U. S. Gasket Corp., Camden, N. J. "Double-Seal" Ball Valve manufactured by Jamesbury Corp., Worcester 5, Mass.)

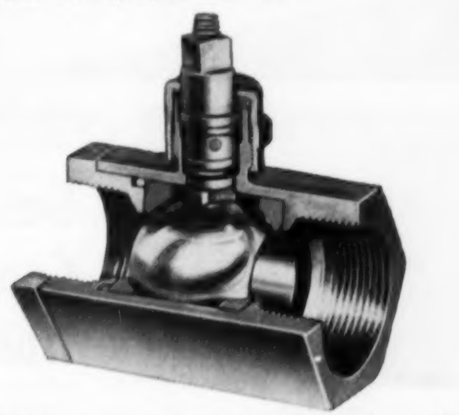


**LUCITE®** makes possible industrial embedments such as this. A variety of products can be embedded in crystal clear "Lucite," either singly or in patterns giving instructive and attractive exploded-view effects.

**ZYTEL®** is the only material used in this "Nylon-Maid" shower head. It eliminates any chance of corrosion, is tough, resilient, and offers years of trouble-free service. "Zytel" is easily injection molded.

# product engineering

**Send for more information.** Why not evaluate your own design problems in terms of Du Pont engineering materials. Complete property and application data are available to you without cost or obligation. Clip and mail the coupon at right for this information.



**TEFLON®** provides a tight, chemically inert seat for this "Double-Seal" ball valve. It affords zero moisture absorption, excellent low-temperature toughness and superior heat resistance.

DU PONT

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Please send me more information on the Du Pont engineering materials checked: ☐ "Zytel"*; ☐ "Alathon"*; ☐ "Lucite"*; ☐ "Teflon"*.
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*Type of Business* ______

**Registered trademark of E. I. du Pont de Nemours & Co. (Inc.)*

# Now–it's "Wall

The fast-growing trend from wallpaper to "wall-plastic" holds much promise as a great, new field of application for vinyl resins.

Pictured at right is one of the early steps in the manufacture of *Cohyde* – a premium-quality, plastic coated fabric especially designed for use as a commercial, institutional and industrial wall covering.

This heavy-duty covering is made with a plastisol based on PLIOVIC AO–a vinyl copolymer resin. It is outstanding in its three-dimensional beauty and durability. It is designed to make the most of a momentum-gathering market.

PLIOVIC AO was selected for this application because it can be processed at relatively low temperatures. This not only makes for easier, more closely controlled production, but results in a more uniform product of better physical properties, by virtue of a shorter heat history being acquired.

Plastisols are economically compounded and processed with PLIOVIC AO, because it is an internally plasticized copolymer. This means its fine particles are more easily solvated than those of other resins, permitting use of a wider range of lower cost plasticizers and minimizing grinding. It also means the dispersion can be fused at as low as 280° F. for greater latitude in equipment and fabrics used.

If you plan on entering the "wall-plastic" field or on manufacturing any vinyl coated fabric, you'll find it to your advantage–processing- and product-wise–to know more about PLIOVIC AO. For details and the latest Tech Book Bulletin, write to:

Goodyear, Chemical Division, Akron 16, Ohio




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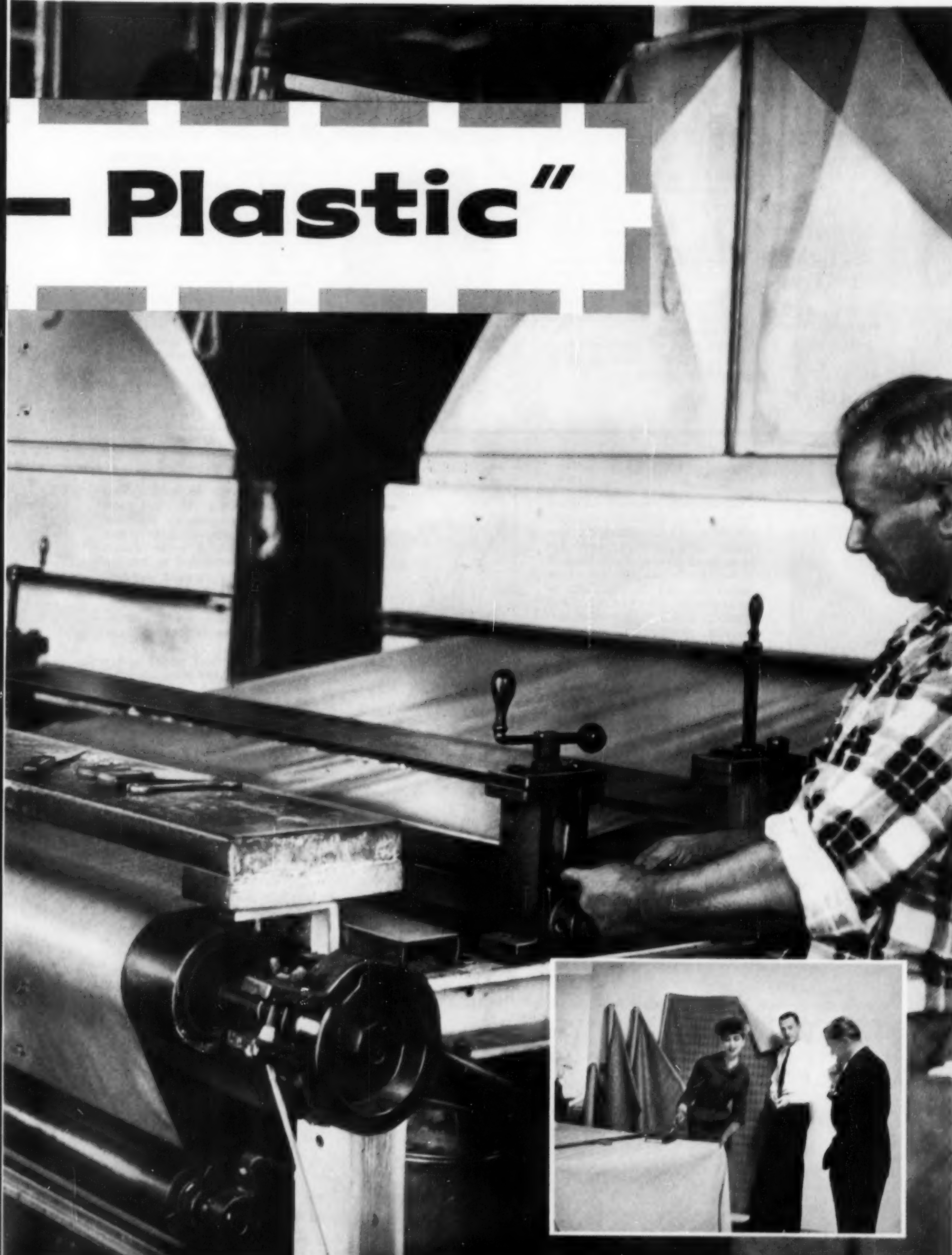
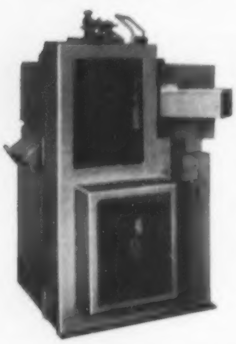


Photo courtesy Cotan Division, Interchemical Corporation, Newark, N. J.

Cohyde—T. M. Interchemical Corporation, New York, N. Y.

# CUMBERLAND
## Plastics Size-Reduction Machinery

### Cumberland "Stair-Step" Dicing Machines



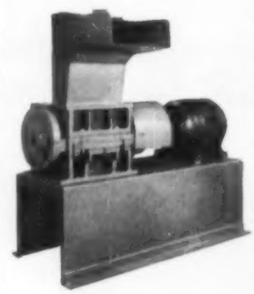
For dicing the *full range* of thermoplastic materials.

Cubes 1/16" to 1/2" produced from plastic sheet or ribbon stock. Pellet sizes altered merely by changing knives. Cubing is done in one severing operation with rotor knives cutting against one bed knife.

All surfaces contacting plastic materials are of corrosion-resistant metals.

Two sizes of machine available to handle sheets up to 7" and 14" in width.

### Cumberland Model 20 All Steel Granulator

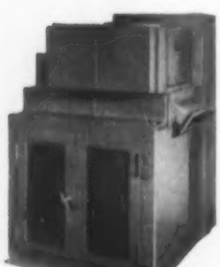


This heavy-duty all steel machine with 8" by 20" throat opening is suited for granulating tough plastic materials in the form of slabs, bleeder scrap, cylinder purgings, heavy cross-sectional parts, etc.

Frame and cutting chamber are of thick weldments with deep welds. Rotor and seal rings are heat treated and ground all over to provide tough, undamageable parts. Hardened surfaces preserve new appearance.

Machines resist wreckage. All inner surfaces are ground smooth to provide ease of cleaning.

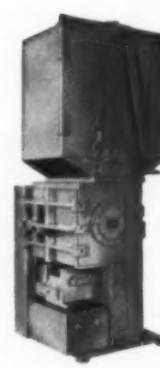
### Cumberland Pelletizing Machines



A versatile machine designed for use as a pelletizer, chopper or dicer. As a pelletizing machine: cuts multiple extruded strands of plastic material into cylindrically shaped pieces or cubes for use in molding or extrusion machines. As a notched knife dicing machine: handles principally vinyl sheet stock. A less expensive dicing machine although less universal than the Cumberland "Stair-Step" Dicer. As a chopping machine: efficiently cuts rubber and vinyl slabs into small pieces.

Available in two sizes to handle stock widths up to 14" or 24".

### Cumberland Pre-Breaker Granulators



Universal in its application, this dual rotor machine combines a pre-breaking machine and granulating machine in one compact unit. A large throat opening is provided to accommodate bulky reclaim as vacuum formed parts or trim. Also handles extra large and bulky parts and pieces of heavy cross-section as bleeder reclaim slabs, purgings, etc.

A special dome added to top of hopper makes machine ideal for long lengths of extruded pipe, rods, contours and similar items.

Unique hopper prevents any flyback.

Available in two sizes with 12" x 24" or 20" x 36" throat opening.

## GRANULATING MACHINES
### For Central Granulating and Use Beside the Injection Press

**CUMBERLAND MODEL 0 — V-Belt or Direct Coupled (2 models)**
For use beside each injection molding machine. Also for laboratory and miscellaneous uses.
Motor: 1½ or 2 h.p. Throat: 3¾" x 5½"

**CUMBERLAND MODEL ½ — V-Belt or Direct Coupled (2 models)**
For use beside each injection molding machine. Also for laboratory and miscellaneous uses.
Motor: 3 h.p. Throat: 4" x 8½"

**CUMBERLAND MODEL 1½ — Direct Coupled**
For central granulating use.
Motor: 10 h.p. Throat: 5" x 12" or 8" x 11"

*Write for our Bulletin 260*

**CUMBERLAND MODEL 10 — V-Belt Drive**
For use principally beside the injection press.
Motor: 3 or 5 h.p. Throat: 6" x 10"

**CUMBERLAND MODEL 18 — Direct Coupled**
For central granulating use.
Motor: 20 h.p. Throat: 5" x 18" or 8" x 18"

**CUMBERLAND MODEL 20 — (illustrated above)**

**CUMBERLAND FINE GRANULATING MACHINE**
A machine for granulating to a higher degree of fineness than is possible with conventional machines.
Motor: 25 h.p.

# Celanese

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(CELLULOSE PROPIONATE PLASTIC)

**High Performance Thermoplastic Molding Material with Outstanding Range of Balanced Properties... Available in Choice of Colors and Formulations**

Can you use a plastic that combines great strength with form retention? A plastic with sparkling color, surface beauty, weatherability, freedom from objectionable odor?

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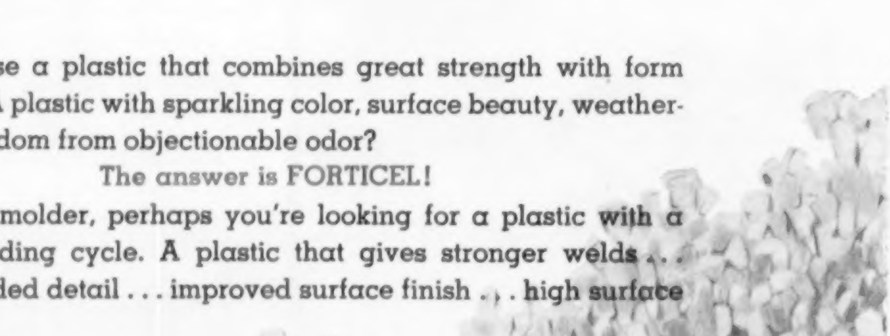
If you're a molder, perhaps you're looking for a plastic with a shorter molding cycle. A plastic that gives stronger welds . . . superb molded detail . . . improved surface finish . . . high surface



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Price, complete with 1¾"—8 thread, 5" nozzle, 3/16" orifice, ½" or ¾" radius nozzle. . . . . . . . . . .$176.00

### MODEL C— with Pyrometer

Price complete as shown with 1¾"—8 thread nozzle 3/16" orifice, ½" or ¾" radius . . . . . $410.50

*Write for prices on other nozzle types.*

Send for our 1956 Nozzle Catalog today. You'll find all styles of nylon nozzles described and priced on pages 32-35—with technical notes on nylon molding. Prompt service on all kinds of nozzles by the world's largest and most experienced nozzle specialists.

## INJECTION MOLDERS SUPPLY CO.

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CLEVELAND 20, OHIO


# worth turning to . . .

With its wide acceptance in the field, the H-P-M 48/64 oz. machine has proven that it was designed to meet molders' specifications . . . high capacity plasticizing chamber . . . weigh feeder . . . greater "shot" capacity . . . plenty daylight and stroke . . . quiet pumps . . . subplate mounted valves reducing piping to a minimum . . . actually so many new features that only a few of the important ones are brought to your attention here. Check these features carefully . . . they mean bigger profits for any molding shop.

H-P-M injection machines are available in sizes from 6 to 400 oz. with mold clamping forces from 150 to 3000 tons. Write for Bulletin 5601 today.

***Write for Bulletin 5601 Today!***

HPM

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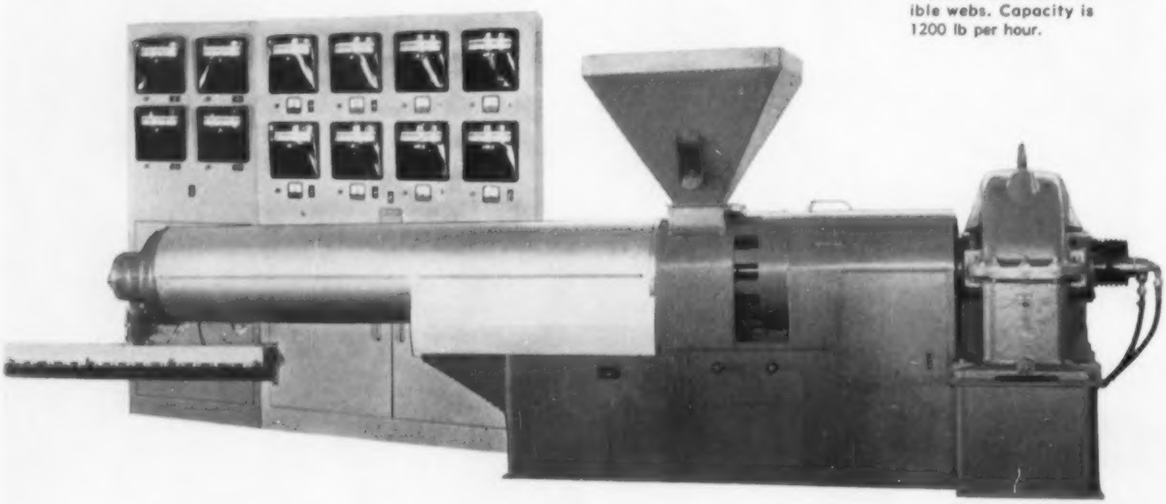
BARBER COLMAN

**Wheelco Instruments**

# "Closest Possible Temperature Control"—Wheelco, of course!

**MORE THAN 90%** of plastic fabricators in the New England Area use Wheelco Instruments, according to official sales records. Wherever plastics machines are used, Wheelco is preferred!



This Egan 8 in. extruder laminates polyethylene to paper and other flexible webs. Capacity is 1200 lb per hour.

"Closest temperature control possible," was the performance requirement specified by engineers of Frank W. Egan & Co. in selecting control instruments for their 8 in. Extruder. Control of maximum precision and dependability is required to maintain tolerances in gauge control in the lamination of polyethylene. Four Wheelco Model 402 Tru-Line time proportioning capacitrols control the temperature of the four zones of heater bands on the extrusion cylinder. Eight Wheelco Model 407 proportioning stepless controllers are used to control one zone of heat on the adapter and seven zones on the die.

Model 400 Series Capacitrols are completely self-contained, direct deflection-type, indicating controllers. They are adapted easily to control requirements of injection molding and extruding machines, as well as plastic packaging and forming machines. Send for Bulletin F-6485 titled "Capacitrols for the Plastic Industry," today!

WHEELCO INSTRUMENTS DIVISION **Barber-Colman Company**

Dept. D, 1517 Rock Street, Rockford, Illinois
Dept. D, Toronto and Montreal, Canada

# General Electric is just one of the many users of Radialloy-Tipped* Circular Saw Blades

Illustrated is a General Electric class being taught Textolite* plastics fabricating with a Radialloy-Tipped* Circular Saw Blade.

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*Thermatron Division*

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IN RADIO AND ELECTRONICS SINCE 1922

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hi-lites
on hi-fax
(TRADEMARK)
and other Hercules plastics
Our Hi-fax plant is underway!
Construction has begun in Parlin, New Jersey
on the new plant which will produce Hi-fax,
a versatile new ethylene polymer made
by the Hercules process.
For more about this important new plastic,
and other new plastics developments
at Hercules, please turn the page.
over
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# facts about hi-fax

Hi-fax is the name of a new ethylene polymer to be made by the Hercules process. Hi-fax provides a completely new plastic with an unusual combination of properties unmatched by any material previously available.

***Hi-fax is truly heat resistant!*** Can be immersed in boiling water without distortion. Insoluble in water or organic solvents below 100°C.

***Hi-fax is rigid and strong!*** Hi-fax has four to five times the rigidity of regular polyethylene. It has double the strength.

***Hi-fax has exceptional low-temperature toughness!*** Retains its impact strength at extremely low temperatures.

***Hi-fax has superior resistance to chemicals, solvents and greases!*** The fluid permeability of Hi-fax is only ⅕ that of conventional polyethylene.

***Hi-fax is richly colorful with an attractive lustrous finish!***

***Hi-fax is easy to fabricate!*** Can be molded by compression, extrusion and injection techniques and machined by conventional methods.

If you make or design toys, housewares, industrial moldings, sheet and film, pipe, bottles, or electrical insulation, Hi-fax offers a *better* plastic for the specific requirements you must meet. That's why we consider Hi-fax the plastic of tomorrow for tomorrow's superior products.

## HI-LITE ON **hercocel**®

In design, production, and sales, versatile Hercocel continues its job of keeping new products on the move. Long-wearing and durable, economical and easy to mold, Hercocel—Hercules® cellulose acetate—is the perfect plastic for many products. The Dormeyer "Edge-Well" Sharpener, for example, is molded with Hercocel and is guaranteed by the manufacturer for one year against defects in material or workmanship. The Hercocel housing for the "Edge-Well" is molded by Plastic Precision Parts Co., 2535 West Madison St., Chicago, Ill. It is a product of the Dormeyer Corporation, Kingsbury and Huron Sts., Chicago 10, Ill.

Cellulose Products Department

**HERCULES POWDER COMPANY**

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CP56-1

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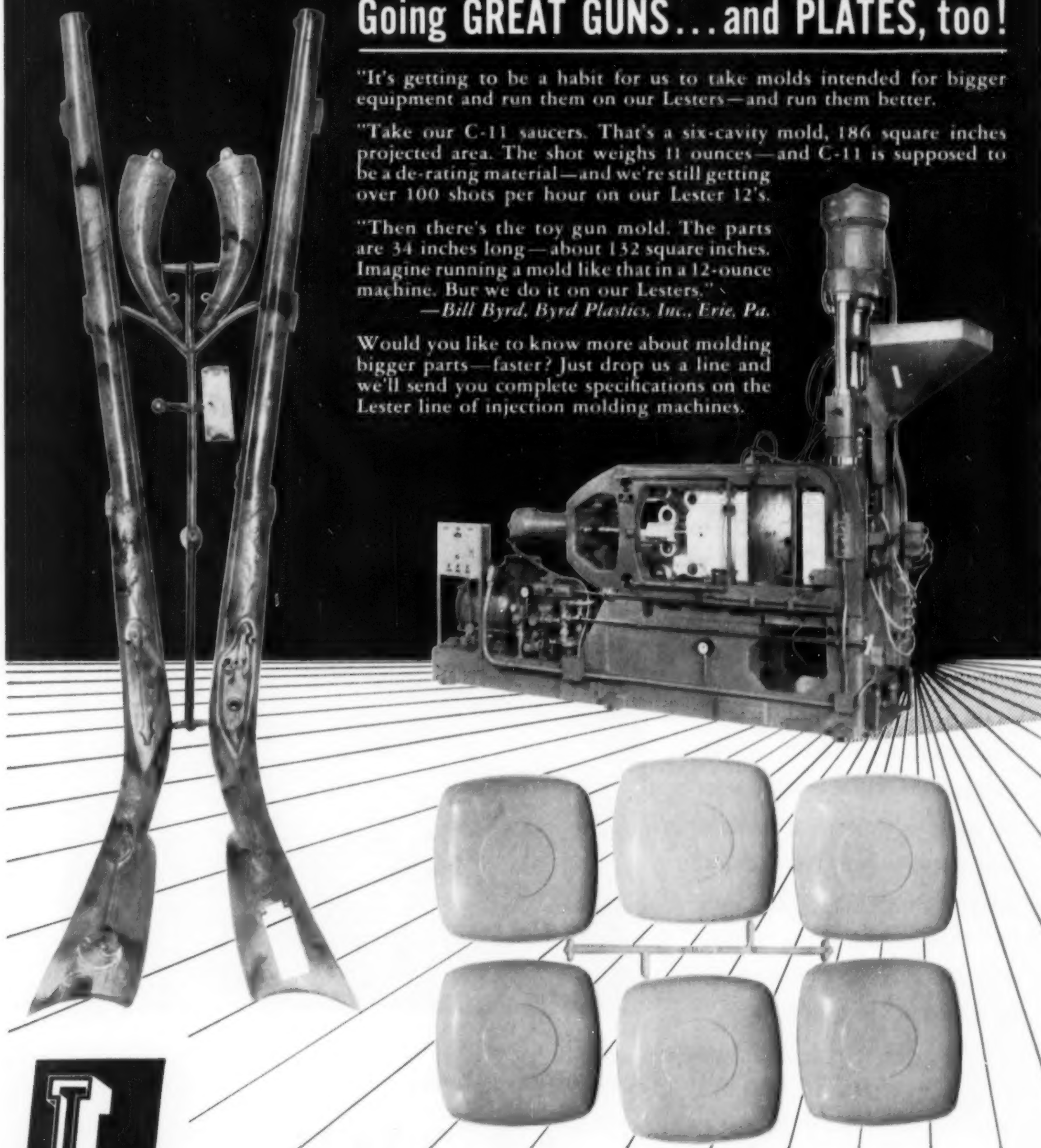
"Take our C-11 saucers. That's a six-cavity mold, 186 square inches projected area. The shot weighs 11 ounces—and C-11 is supposed to be a de-rating material—and we're still getting over 100 shots per hour on our Lester 12's.

"Then there's the toy gun mold. The parts are 34 inches long—about 132 square inches. Imagine running a mold like that in a 12-ounce machine. But we do it on our Lesters."

*—Bill Byrd, Byrd Plastics, Inc., Erie, Pa.*

Would you like to know more about molding bigger parts—faster? Just drop us a line and we'll send you complete specifications on the Lester line of injection molding machines.



## LESTER INJECTION MOLDING MACHINES

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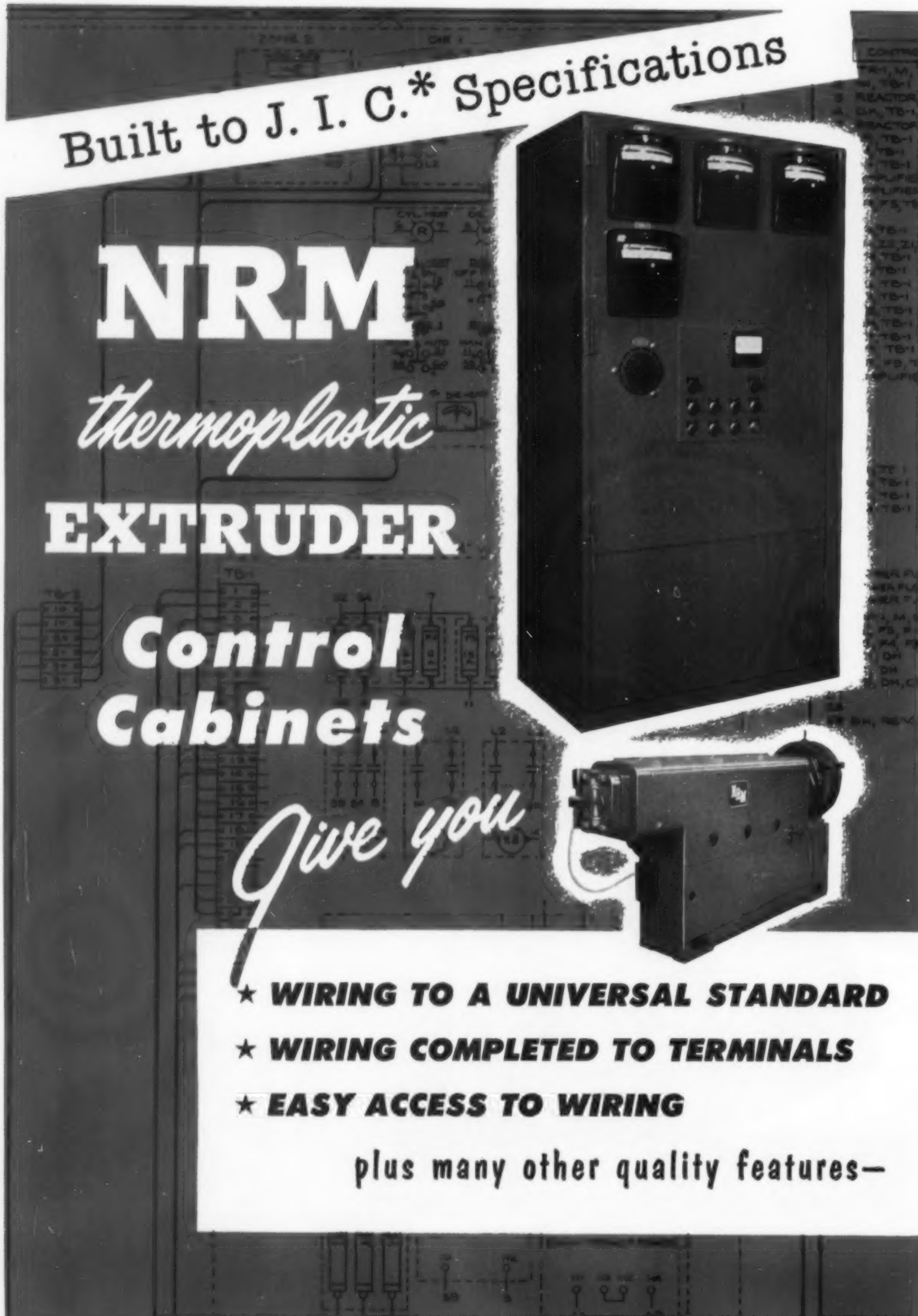
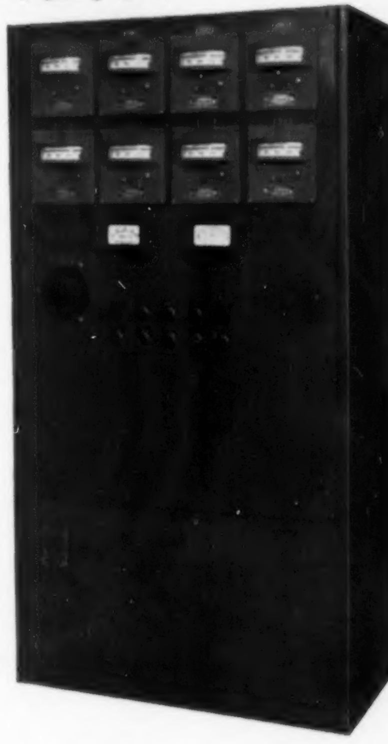

Built to J. I. C.* Specifications
NRM
thermoplastic
EXTRUDER
Control
Cabinets
give you
★ WIRING TO A UNIVERSAL STANDARD
★ WIRING COMPLETED TO TERMINALS
★ EASY ACCESS TO WIRING
plus many other quality features—

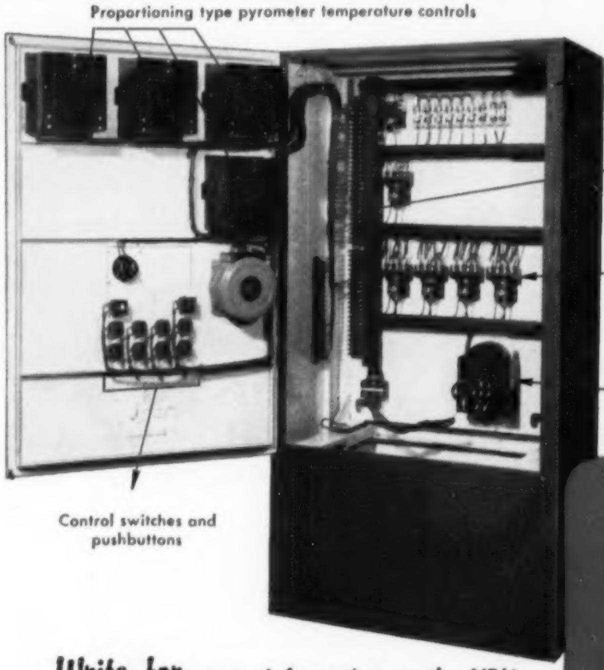
# NRM CABINETS WITH ALL ELECTRICAL CONTROLS FOR EXTRUDER AND DIE ARE *STANDARD EQUIPMENT*

In providing the finest, most compact and most *dependable* electrical controls for NRM Extruders, we spare no pains nor facilities in the manufacture of NRM Control Cabinets. They are designed by electrical engineers, and are constructed in special departments in our own plant by trained electricians. The work is an industry in itself. The individual fitting, adjusting, inspecting and testing each cabinet receives makes it a "custom" job. Yet, there's no extra cost to you . . . this work is *standard* practice at NRM. Because NRM Control Cabinets are built and wired to the universally accepted standards of the Joint Industrial Council, NRM Extruders can be operated under local codes *anywhere*. Cabinets are completely wired, with circuits labeled at each end and keyed to J.I.C. wiring diagrams. Access doors are equipped for gasket sealing where required. Cabinets with all electrical controls for operating extruder and die are available in standard lines for all NRM Extruder sizes.



A typical control cabinet for 2½" to 6" NRM Plastics Extruders with dies. This one is equipped with: Proportioning type temperature controls (for eight heating zones), ammeter, tachometer, powerstat, and all control switches and pushbuttons.

Proportioning type pyrometer temperature controls



Heavy sheet metal fabricated cabinet

Coded circuit terminals

Heater contactors

Control circuit transformer

Control switches and pushbuttons

**Write for** more information on the NRM full line of Thermoplastics Extruders and equipment. See how their many advanced design features — like J.I.C. Control Cabinets, for instance — contribute to easier, less expensive and more profitable plastics extrusion.

*Joint Industrial Council

2569

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WEST: S. M. Kipp, Box 441, Pasadena 18, Cal. SYcamore 4-2110

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# The Plastiscope

April 1956

News and interpretations of the news

By R. L. Van Boskirk

## Section 1

**Methacrylate is all aquiver.** If a plastics man can't get excited about what's going on in methacrylates, he must be as stoical as a red Indian. For the fourth time in 18 months, Rohm & Haas and Du Pont have reduced the price of methacrylates. Standard, colorless molding grade is now 55¢ delivered, down from 59 cents. Colored grades are now 59 cents. In 1000-lb. containers, the prices are ½¢ less. Monomer is reduced from 32 to 29 cents. Price reductions ranging from 3 to about 9½% have also been made by Rohm & Haas on cast sheet Plexiglas R, II, and IA in thicknesses of 0.100 in. and over. Du Pont reduced the price of granular or unpelletized resin from 55 to 51 cents. This latter resin is claimed to be particularly adaptable for extrusion of sheet. The idea, of course, is to grab off a bigger chunk of the market for thermoplastic molding and sheet material. Perhaps a more subtle reason is to scare off prospective new producers who are reported to be "looking around."

**More methacrylate news.** Noteworthy is Cadillac Plastic Co.'s announcement of cast methacrylate sheet 5 to 10 in. thick, claimed to be perfectly clear with no bubbles or flaws; it eliminates the necessity for laminating to obtain heavy thicknesses. Cast Optics Corp., another producer of methacrylate sheet, asserts that it is producing 400 sheets of cast methacrylate every day. Thicknesses vary in the usual range, with a maximum sheet size of 48 by 72 inches. A great portion of the output is going into signs. Cast Optics has also been producing for some time a copolymer of methacrylate and another material. It is widely used for watch crystals, is break resistant, and has unusual optical properties.

**Bigger wagons in polyethylene parade.** Eastman Chemical will boost its polyethylene capacity to 40 million lb. annually—almost twice present capacity—with new facilities to come in later this year. The company has also announced two new basic formulas, 834 and 842, with improved stiffness and clarity. According to Eastman, these new formulas will put the company into the film-grade resin market with a material equal to any other polyethylene available. The added stiffness is primarily of interest in molding materials, especially the so-called softer or high-melt-index materials used frequently for large housewares items. The high-clarity resin, 842, sells for 43¢; the 834 resin, for either film or molding, sells for 41 cents. They are available in modified versions to obtain greater block resistance and whatever degree of "slippage" the customer desires.

**Higher-density conventional polyethylene.** Du Pont also has added two new polyethylenes, each with a density of 0.930, highest of any of the high-pressure polyethylenes. Highest-density Du Pont polyethylene heretofore was Alathon 10, at 0.923. (Low-pressure polyethylene has a density of 0.960, has higher heat resistance and more stiffness. Density is roughly equivalent to specific gravity.) Of the two new resins, Alathon 34 gives clarity, crispness, and sparkle in a film that is especially suitable for soft goods packaging and for small packages of moist foods and liquids. Because of good impermeability, higher heat distortion, and stiffness, it is also suggested for bottles. Alathon 37 is a high-flow, fast cycle polyethylene, which because of its stiffness, gloss, and higher heat distortion is particularly adaptable for housewares. Price of both new resins is 43¢ a pound. Du Pont's former

*Reg. U. S. Pat. Off.

10 and 20 grades, used primarily for film and bottles, are reduced from 43 to 41¢; the pipe grade, 25, is raised from 35½ to 38 cents.

**More polyethylene film-grade resin.** Demand for high-quality polyethylene film-grade resin has always exceeded supply, but indications are that the supply line for such resin is being heavily reinforced. Spencer Chemical is now satisfied that its film-grade resin is ready to compete with any other on the market. Their new film grades are Poly-Eth 2205, 2215, and 2235. The first is suggested for drum liners, seat covers, construction uses, and soft goods packaging. The second, for packaging uses, offers a balance of slip and block resistance while maintaining clarity and strength; it will take conventional treatment for printing. The third has exceptional clarity and strength with high slip and unusual block resistance. It should be noted that producers of film resin now emphasize clarity and block resistance at the same time. The industry is making progress: blocking has heretofore been a major handicap to production of good, clear film.

**Grace polyethylene plant.** The W. R. Grace low-pressure polyethylene plant is now under construction near Baton Rouge, La. A $1 million semi-works plant is expected to go into operation this summer. A 50 million-lb.-capacity plant to be built there is expected to be on stream in October 1957. An Esso Standard Oil plant nearby will provide the ethylene. Grace polyethylene in U. S. will be produced under a Phillips license; in Brazil, under a Ziegler license.

**Koppers plans new plants.** Koppers Co. will build its eastern polyethylene plant in Middlesex County, N. J. Capacity will be 30 million lb. for low-pressure, linear, Ziegler-type polyethylene. Production is scheduled to begin early in 1957. Together with Brea Chemicals, Inc., a subsidiary of Union Oil of Calif., Koppers will also build a $10 million plant with an ultimate annual capacity of 60 million lb. of linear polyethylene; location will be in Los Angeles County, north of Wilmington, Calif.; operation is expected to start in mid-1957; facilities for production of ethylene monomer will be included. Brea will operate the plant with technical assistance from Koppers. Koppers is now operating an 18 million-lb. high-pressure polyethylene plant near Pt. Arthur, Texas, and a good-sized semi-works plant at Kobuta, Pa., where semi-commercial quantities of low-pressure polyethylene are produced.

**Ethylene unit in New Jersey.** Esso Standard Oil is building, at Linden, N. J., what is said to be the first installation for production of concentrated ethylene in the east. Completion is expected late in 1956, but capacity has *not* been announced. Ethylene is used for polyethylene, anti-freeze, and many intermediate chemicals. Both Hercules and Koppers have announced that they would build polyethylene plants in N. J.

**Nylon emulsion for bonding and coating.** Belding Corticelli Industries Inc. has started production of nylon emulsion identified as BCI Nylon Dispersion, manufactured from Type 8 nylon resin. It can be applied by dip coating, roller, or spray, and will produce a heat-sealable finish. Some of its uses are for bonding non-woven fabrics; for imparting abrasion resistance to woven or knitted fabric; for increasing the wet and dry strength of paper; for coating rubber to increase abrasion resistance; and as a petroleum barrier.

**Another styrene plant.** Cosden Petroleum Corp., Big Spring, Texas, is building a $3 million styrene monomer plant with a capacity of 20 million lb. a year. This is only one of several announcements concerning styrene that may be expected soon, all centered around the rapidly growing use of styrene in plastics. Obviously, however, a number of eyes are turned toward that 1.5 million-ton rubber market in the U. S. where the proportion of natural

(*To page 43*)


## why key parts are molded from Gering's thoroughly compounded formulations!

They're long-lasting, eye-catching, durable beauties for the youngest post-diaper set . . . and there's a mighty good reason why Gering polyethylene formulations went into production of these toys!

For the molder gains much more than sure color matching and dependable quality. Gering custom compounded polyethylene gives the molder faster production cycles, easier mold release, less rejects . . . all adding up to low costs for high quality jobs.

Gering custom compounds *all* thermoplastics for extrusion and injection molding . . . special or standard formulations, varied colors and special effects. All developed to your needs by Gering technicians . . . delivered to your shop ready to mold!

Why not get all the facts on Gering custom compounding service in time to start boosting profits on your next quality molding job! Write today for full information.

**GERING**

**PRODUCTS INC.**

**KENILWORTH, N. J.**

*Pioneers in modern plastics for over 30 years!*

rubber is destined to become smaller and smaller from year to year, according to well-informed persons in that industry. Over 700,000 tons was GR-S in 1955.

**Unplasticized PVC pipe producer.** The Alloy Tube Div., Carpenter Steel Co., Union, N. J., is now marketing rigid unplasticized PVC pipe, the first non-metallic product ever produced by the company. The customary normal-impact grade with high chemical resistance and the modified grade with high-impact but less chemical resistance are being offered in pipe from ½- to 4-in. sizes. Threaded and socket-type fittings are also available. Distribution will be through Carpenter outlets for tubing and pipe for corrosive service.

**Armored cables.** Monsanto Chemical Co.'s Plastics Div. asserts that the recent successful evaluation of armored cables with thermoplastic-insulated conductors by Underwriters' Laboratories is a "milestone in the march of vinyl chloride." Together with several cable companies, Monsanto has developed conductors insulated with Opalon vinyl which meet Type T requirements of the National Electrical Code. The Code has provided for such cables since 1947 but, according to Monsanto, they had not previously been successfully evaluated.

**Propionaldehyde in tank cars.** A broadly useful chemical with applications that parallel acetaldehyde, propionaldehyde is now available in tank car lots from Carbide and Carbon's new Oxo unit at Texas City. In plastics it can be used with phenol to make resinous products; with formaldehyde it yields an intermediate for alkyds; and it is useful in polyester resins for making polyurethane.

**Mylar and felt.** An interesting combination of Mylar film and soft felt has been brought out by Felters Co., Boston, Mass. The laminate, available in numerous types, has the softness of felt and the durability of Mylar. It is expected to find applications in fashionable apparel and accessories, and in automobile and airplane interiors.

**New polyvinyl chloride plant.** Borden Co. is building a new vinyl plant of 12 million-lb.-a-year capacity at Leominster, Mass. It is scheduled for completion in June and is near the company's present Monomer Dept. plant which produces polyvinyl alcohol and polyvinyl acetate. The new facilities will produce specialty resins, vinyl chloride latices, and general-purpose vinyl for calendering and extrusion. Contractors are Scientific Design Co.

**Strippable coating for laminates.** A new and inexpensive strippable coating for laminate surfaces to protect them during manufacture or in transit is being marketed by Kenmore Sales Co., Newton, Mass. It protects against scratches and glue spots and can be used with kraft paper to supplant masking tape.

**Vinyl chloride monomer plant.** Solvay Process Div., Allied Chemical & Dye Corp., has made the long-expected announcement that vinyl chloride monomer would be forthcoming from its Moundsville, W. Va., plant this spring. No comment concerning capacity is given. Hydrogen chloride will be obtained from Solvay's nearby chloromethane operations while

acetylene will be piped to the plant from a nearby installation being erected by Linde Air Products Co. Allied Chemical has also announced that its Semet-Solvay Tonawanda, N. Y., plant is now producing propylene. Propylene is a potential material for use in plastics that deserves careful attention. A German expert recently classified it as a possible base for a low-cost plastic that could rival anything now on the market.

**Have a look at boron.** Every now and then someone gets excited about the use of boron in plastics, but reliable information on the subject is mighty difficult to locate. American Potash & Chemical, in announcing a 35% price decrease in elemental boron, states that one of boron's possibilities is in shielding from atomic radiation, for which purpose it is combined with plastic or aluminum to provide a lightweight, small-space shield for reactors, replacing lead and concrete.

**Wood-grain finish on thermoplastics.** A realistic wood-grain finish has been made an integral part of the surface of a rubber-modified styrene sheet by Campco Div., Chicago Molded Products Corp. The new Campco sheet can be formed into complex three-dimensional shapes without damaging the finish. It is available with blond mahogany, dark mahogany, and driftwood finishes; when transparent colors are applied to the sheet, the wood grain shows through so that many other types of wood may be simulated by varying the color.

**Extruded nylon.** Kemtek Corp., Newark, N. J., has installed new extruders for producing round nylon rod from ¼- to 2-in. diameter. The company is also doing development work on extrusion of nylon tubing and of film in the ½- to 5-mil range.

**Urethane-lined jackets.** A new and promising market is developing for polyurethane foam that could have almost limitless possibilities in a market that seems almost made-to-order for capitalizing on urethane's properties. A manufacturer of men's jackets initially bought enough of American Collo's Fabricollo urethane foam lining for 8000 jackets; the first samples were so popular that he took orders for 35,000 jackets! The urethane foam lining used is 2¼-lb. material, sliced to about ⅛-in. thickness. There are normally about 2 to 2½ yd. in a jacket. The consumer cost would be from 50 to 75¢ more per garment for urethane lining than for conventional fiber batting, but the urethane will withstand washing or dry cleaning without loss of insulation value or shrinkage. The urethane is also said to have a warmth coefficient equivalent to a 14- or 16-oz. fiber bat. The lining can be quilted by sewing to rayon if desired. In addition to its use in men's jackets, it is also suggested for ladies' and children's jackets, men's overcoats, and for lining sport caps.

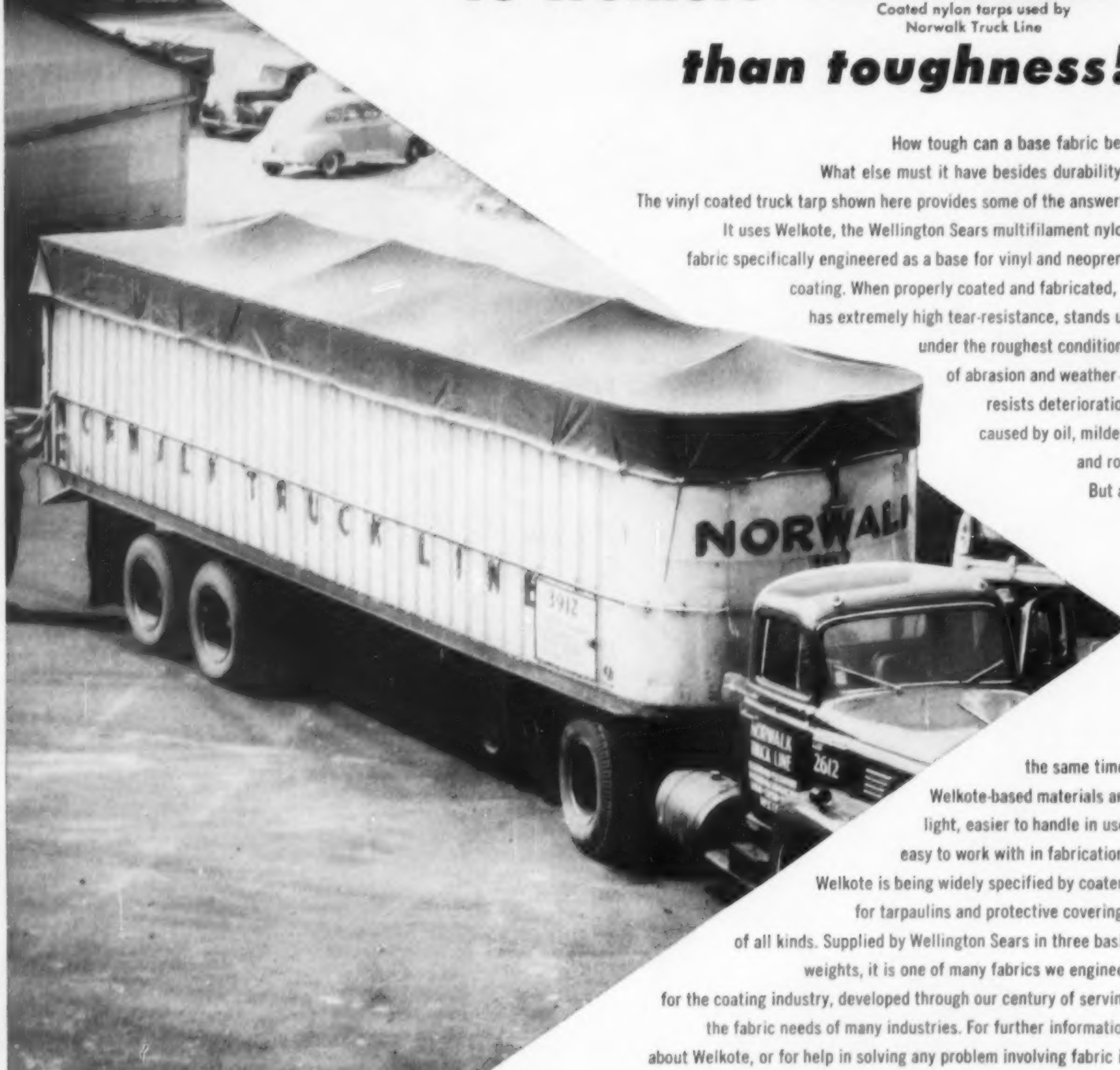
**Saran bag for candy.** Bags of saran film, 1¼ mil thick and color-printed by rotogravure, have been developed by Printon Corp.; they are being furnished for use in packaging Phoenix Candy Co.'s toffee. It is claimed that the candy does not stick to the saran, as it did to the cellophane previously used. The bags can also be re-used to protect other foods. Saran candy bags are not exactly new, but heretofore printed saran bags have usually been made of two plies; development of printing and handling equipment for making single-ply bags should be an important factor in the quiet but steady growth of saran in a market that has tremendous volume possibilities.

**Coated fabric plant expansion.** Some $3 million will be spent on expanding Du Pont's Newburgh, N. Y., coated fabric plant. A new calender will be added and the vinyl solution facilities will be modernized. This plant has been operated by Du Pont for 45 years and the number of employees has grown from 100 in 1910 to more than 1000 today.

*For additional and more detailed news see Section 2, starting on p. 278.*

# There's more to Welkote than toughness!

Coated nylon tarps used by Norwalk Truck Line




How tough can a base fabric be? What else must it have besides durability? The vinyl coated truck tarp shown here provides some of the answers. It uses Welkote, the Wellington Sears multifilament nylon fabric specifically engineered as a base for vinyl and neoprene coating. When properly coated and fabricated, it has extremely high tear-resistance, stands up under the roughest conditions of abrasion and weather—resists deterioration caused by oil, mildew and rot. But at the same time, Welkote-based materials are light, easier to handle in use, easy to work with in fabrication! Welkote is being widely specified by coaters for tarpaulins and protective coverings of all kinds. Supplied by Wellington Sears in three basic weights, it is one of many fabrics we engineer for the coating industry, developed through our century of serving the fabric needs of many industries. For further information about Welkote, or for help in solving any problem involving fabric in combination with rubber or plastics, call us. Put our experience to work for you. For informative booklet, "Modern Textiles for Industry," write Dept. **K-4.**

## Wellington Sears

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***FIRST In Fabrics For Industry***

*For Coated Materials, High and Low Pressure Laminates and Other Reinforced Plastic Products*

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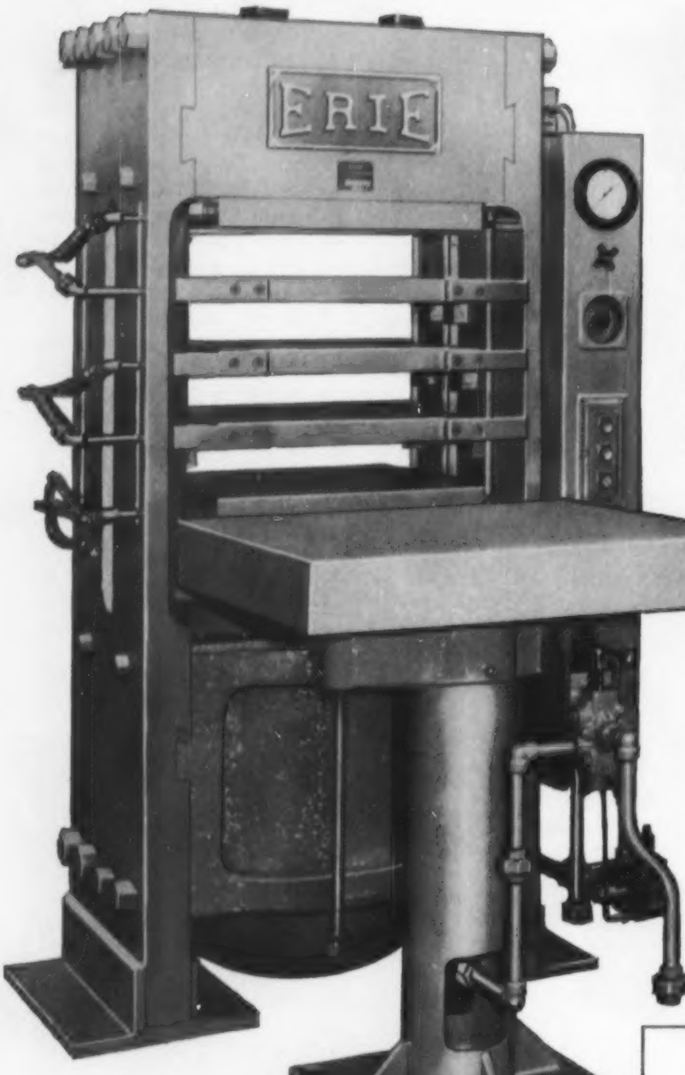
# Erie Press of the Month

# COMPRESSION MOLDING PRESS




**CASE HISTORY # 1**—Our customer was setting up a complete rubber molding line. His press tolerances were close—platens must stay parallel within .002. He wanted automatic curing cycles, including high-speed closing, changing to slow speed—high tonnage at first contact, then a series of bumps for degassing.

Our molder wanted a hydraulic power system that was compact and would operate with minimum maintenance and maximum safety.

Erie Foundry Co. designed and built two 314 ton strain plate presses which surpass our customer's specifications. They give *minimum deflection* and have adjustable tapered platen guides to maintain alignment. Best of all, these Erie Presses are *flexible* . . . adaptable to almost every compression molding job and are readily converted to transfer molding.

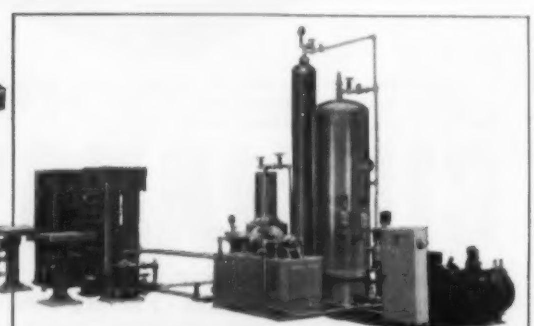
ERIE

We're constantly designing and building self contained and system powered presses, lift tables, and hydraulic power plants for compression molders. Why not discuss your requirements with a hydraulic press engineer from Erie Foundry? Write for information.

*Hydraulic Press Division*

**ERIE FOUNDRY CO.**

**ERIE, PA.**



**WE BUILT THE HYDRAULIC POWER SYSTEM, TOO!**

High and low pressure power is supplied the two presses and lift tables (and 4 more can be added later) by this electrically controlled Erie Hydraulic Power System . . . compact, lightweight, easy to maintain, safe to operate.

# Woodall Industries, Inc. uses Paraplex Resin in mass production of automotive parts

By using a pre-mix molding technique based on PARAPLEX polyester resins and various reinforcing agents, Woodall Industries, Inc. is *mass-producing* high-quality automotive parts. Six years' experience at Woodall have proved that properly engineered and compounded reinforced plastics compete successfully with—and even exceed—steel and other materials in economy and performance. For such parts as heater housings, air ducts, speaker mounts, arm rests, kick panels and defroster nozzles, tough but lightweight, corrosion-resistant, sound-deadening reinforced PARAPLEX P-series resins are ideal.

Woodall chose a PARAPLEX molding resin because it:

- maintains high viscosity at molding temperatures
- has good hot-strength
- is highly reactive, thus cures rapidly
- has excellent uncatalyzed stability
- has low flexural modulus in relation to its flexural strength

For more information on the PARAPLEX resins, write to Department WEW-1-6.

*Paraplex is a trade-mark Reg. U.S. Pat. Off. and in principal foreign countries*

*Chemicals for Industry*

**ROHM & HAAS COMPANY**

**THE RESINOUS PRODUCTS DIVISION**

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**Guarantee TOP Performance and Maximum Life!**

# *Specify* THESE TOP QUALITY FEATURES...

**(Standard on Miller Cylinders at no extra cost)**

**Specify CASE HARDENED CHROME PLATED PISTON RODS**
On all Air and Hydraulic Cylinders

### Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

**Specify "TEFLON" WIPERS**
On all Air and Hydraulic Cylinders

**Specify TEFLON HYDRAULIC ROD SEALS**
On all Hydraulic Cylinders

### Benefits To You

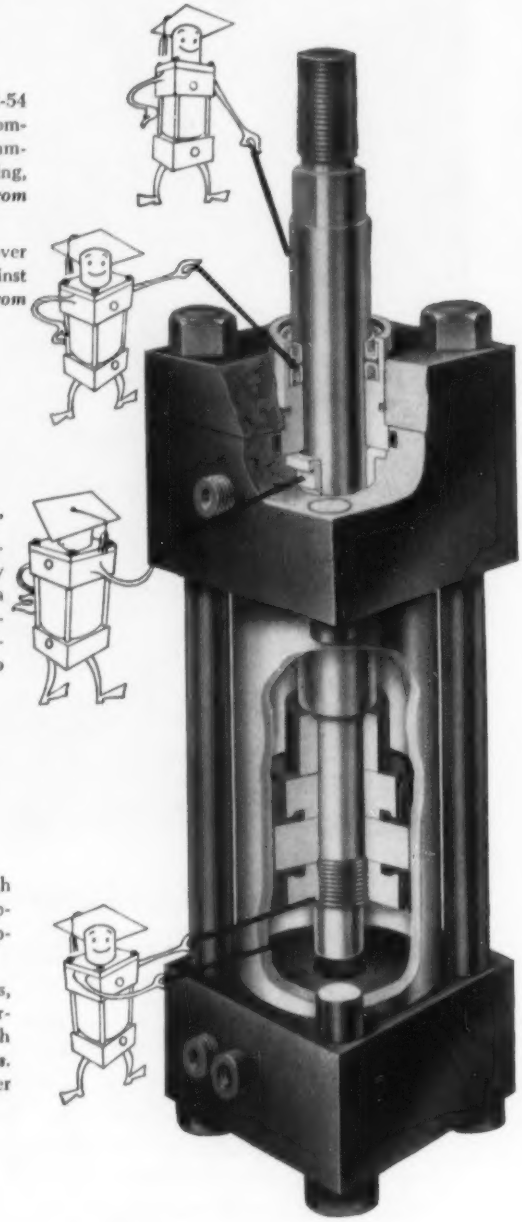
"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

**Specify RUST RESISTANT SURFACES**
On all Air and Hydraulic Cylinders

### Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



*You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request.* →

To (Dept.)________________
"On all our future cylinder requirements, please specify the above quality features."________________
Signed________________
Title________________

**NOTE.** On all Miller Hydraulic Piston Seals: Leather Cup Seals are *standard,* Piston Ring Seals are optional at *no extra cost,* and "Teflon" Cup Seals are available *at extra cost.*

**MILLER FLUID POWER DIVISION**
FLICK-REEDY CORP.

***SALES AND SERVICE FROM COAST TO COAST***

CLEVELAND • YOUNGSTOWN • DAYTON • TOLEDO • CINCINNATI • COLUMBUS PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY BUFFALO • ROCHESTER • MINNEAPOLIS • GRAND RAPIDS • DETROIT • FLINT FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • ATLANTA TORONTO, CANADA and OTHER AREAS

Miller

**2020 N. Hawthorne Ave. Melrose Park, Ill.**

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

# MINI-JECTOR

TRADE MARK

## PLASTIC INJECTION MOLDING MACHINES

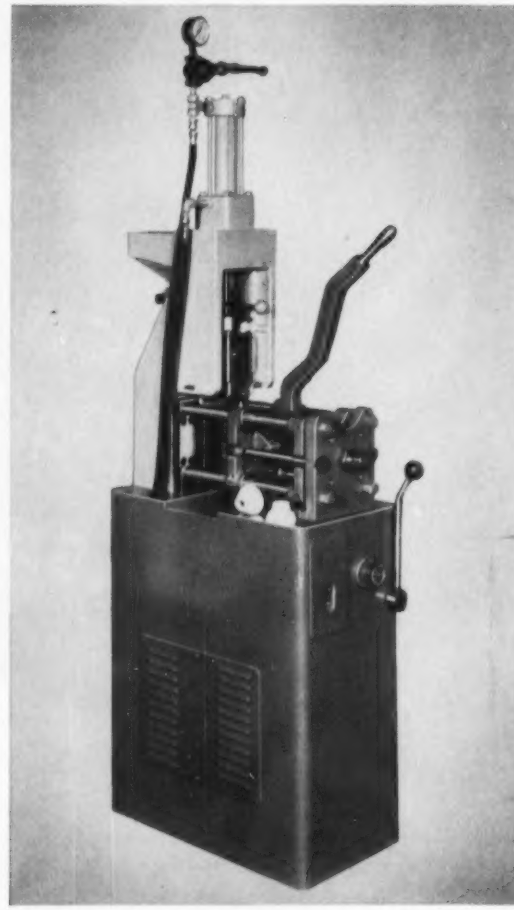
## For Economical

### MOLDING OPERATIONS ON SMALL JOBS

Mini-Jectors are small production machines. They offer the most economical way of injection-molding small plastic articles (¾ oz. or less) where there is no need for high-speed production.

In addition, Mini-Jectors are ideal equipment for developing new plastic products. You can make up a few dozen, several hundred, or thousands in the exact color and design to test market reaction before you tool up for full production. In many cases, the Mini-Jector will take care of the entire production requirements.

Any Thermoplastic including NYLON may be molded with a Mini-Jector.



**MODEL 60 "HORNET"** ¾ oz. injection capacity. Mold size 6" x 5" x 5⅛". Will plasticize 5½ lbs. per hour. Hydraulic injection system, also available for air operation . . . semi-automatic knockout speeds operation and mold change.

**MODEL 45 "WASP"** ¾ oz. capacity air-operated Mini-Jector . . . fast and economical. 6" air cylinder operates ram . . . 40 to 150 pounds of air pressure required depending on type of plastic used and product being molded. Material hopper capacity 4 pounds.

Mini-Jectors are available in two basic models, the "Wasp" and "Hornet" series. The "Wasp" series uses only the inexpensive "V" type mold which is removed once in each operational cycle. The "Hornet" series mold blank remains in the machine and the part is removed or ejected either manually or mechanically. "Hornet" mold blanks also provide more mold area.

The "Wasp" series are available for operation either manually, by air, or hydraulically. The "Hornet" series operates only by air or hydraulic systems.

***EVERY DAY THOUSANDS OF ITEMS ARE BEING PRODUCED PROFITABLY ON THE MINI-JECTOR***

**WRITE TODAY . . . for literature telling how Mini-Jector may help solve your injection molding problems, to . . .**

**NEWBURY INDUSTRIES,** 2023 Munn Road, Newbury, Ohio

*"Specializing in the Production and Development of Plastic Injection Molding Machines of one ounce or less capacity"*

# Product-Building for Profits with Monsanto Plasticizers

**One-Stop Raw-Material Service . . . Expert Technical Guidance**

Product-building with Monsanto plasticizers can reduce your formulation and processing costs, can improve your finished products.

Monsanto is America's most diversified manufacturer of primary and secondary plasticizers for all types of plastics processing, and an outstanding source for expert technical information, formulating know-how for vinyls, cellulosics, styrenes, phenolics, melamines, ureas, epoxies.

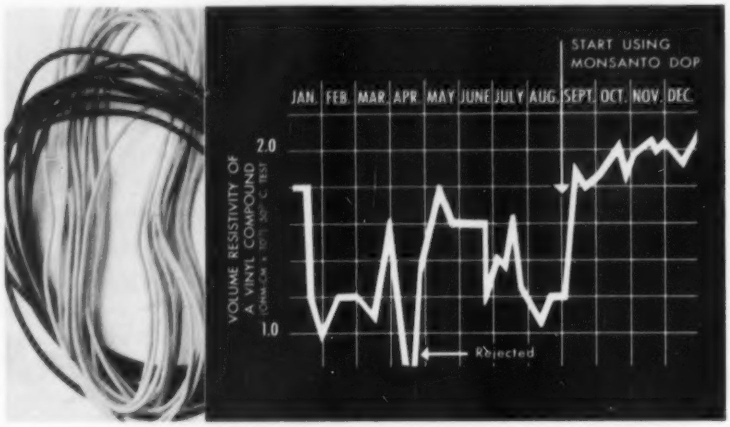
**"Plasticizers Council" Service . . .**

For complete information on product-building new or established raw-material formulations, on modifying end-product properties, consult Monsanto "Plasticizers Council."

# *You can build product quality, reduce costs with Monsanto*

## . . . Wire and Cable

**Uniform Electrical Properties** . . . Monsanto DOP and other electrical-grade plasticizers help wire manufacturers produce high-quality wire and cable products that consistently meet rigid standards for safe load-carrying capacity. The graph shows how one manufacturer's volume-resistivity varied widely with non-uniform DOP, how reliable electrical-grade Monsanto DOP helped him meet specifications and solve a tough quality-control problem.




**Lower Manufacturing Costs** . . . The right choice of plasticizers reduces formulating costs and increases profits. Here's an example of how electrical-grade Monsanto DIDP-E cut costs almost 10% on a pound-volume basis. With the reduced compound costs, Monsanto DIDP-E also substantially improved the electrical properties.

| *80° Wire* | *TCP-Polymeric Plasticized* | *Monsanto DIDP-E Plasticized* |
|---|---|---|
| *Compound cost/pound* | *27.4¢/lb.* | *26.1¢/lb.* |
| *Specific gravity* | *1.37* | *1.30* |
| *Compound cost/pound-volume* | *37.5¢/lb.* | *33.9¢/lb.* |

**Improved Electrical Properties** . . . A recent Monsanto-controlled test of DOP/HB-40 blends for SPT and 60° wire improved electricals about 300%, reduced formulation costs 5%. Many wire manufacturers use blends of Monsanto specialty plasticizers with general-purpose plasticizers to improve electricals, increase production rates, or both.

## . . . Garden Hose

**Quality Plus Cost Control** . . . The unusually wide range of Monsanto plasticizers helps garden hose manufacturers select the exact combination of processing and quality features needed for balancing costs with market prices. Monsanto chemists have gathered formulation and cost data for hundreds of vinyl compounds in a wide cost range for clear and opaque stock. Formulation data is available to all garden hose customers.

## . . . Medical and Beverage Tubings

**Non-Toxic Plasticizers** . . . Monsanto early recognized the value of non-toxic plasticizers in the growing market for plastic food and medical tubings, and pioneered in the development of plasticizers to meet BAI and FDA specifications. Santicizer B-16 and Santicizer 141 are in wide use for food and beverage tubings, and have passed rigid feeding tests. Monsanto DOP is used for blood tubing in medical applications.

# *Plasticizers for . . . Vinyl Extrusions*

## . . . Welting, Belting, Gasketing

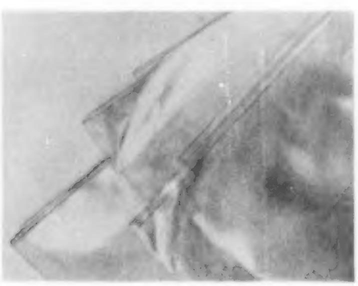
There's a "right" Monsanto primary or secondary plasticizer, or a combination, for virtually every welting, belting, or gasketing product. Here are a few of the processing and end-product qualities Monsanto plasticizers help improve:

**Faster Blending, Extrusion** . . . Monsanto Santicizer 160 is specially designed to increase mixing rates, boost extrusion speed, and lower product costs.

**Better Light Stability, Flame Resistance** . . . Monsanto Santicizer 141 improves weathering properties and imparts flame retardance . . . also increases production rates.

**Less Migration** . . . A small percentage of Monsanto HB-40 in vinyls helps prevent "marring" and "lifting" of wood or other surfaces coated with nitrocellulose lacquers. Low-cost, readily available Monsanto HB-40 also reduces raw-material costs.

**High Soapy-Water Resistance** . . . Soapy water extracts certain plasticizers from vinyl seals and gaskets in washing machines, dishwashers, and other machines exposed to washing or cleaning solutions. Monsanto DIDP offers unusually high resistance to this extracting action, helps build products with longer service life, more sales potential.



## . . . Extruded Vinyl Films

**Faster Fusion, Faster Processing** . . . Monsanto Santicizers 140, 141, 160, and Monsanto TCP help eliminate "fish eyes" in extruded films. Their faster, more thorough solvating action speeds up processing cycles, improves clarity and gloss. Santicizer 141 also meets BAI and FDA specifications for food-packaging films.

# *How buying from a one stop source saves money*

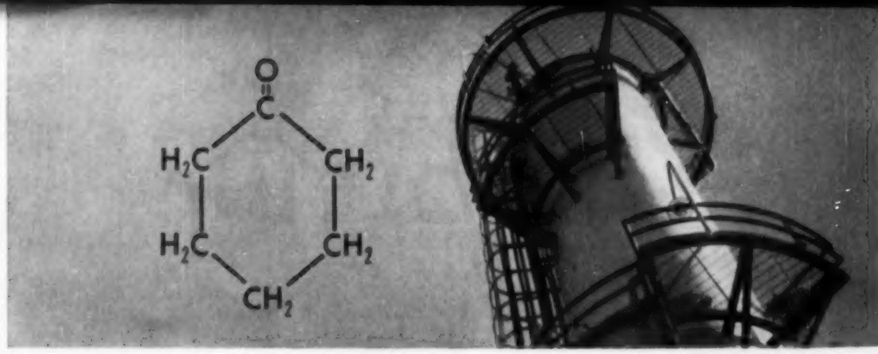
**Case 1**

| Supplier | | Three Suppliers—Three Shipments | |
|---|---|---|---|
| A | DOP | 5,000 pounds | |
| B | TCP | 5,000 " | |
| Monsanto | Santicizer 160 | 10,000 " | Total Cost $6,500 (LTL) |
| | | **One Mixed Truckload From Monsanto** | |
| Monsanto | DOP | 5,000 pounds | |
| " | TCP | 5,000 " | |
| " | Santicizer 160 | 10,000 " | Total Cost $6,300 (TL)<br>You Save $200 on 20,000 pounds |

**Case 2**

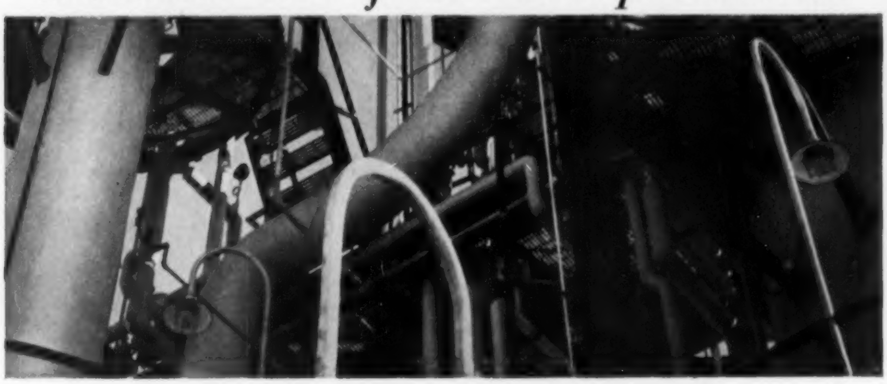
| Supplier | | Two Suppliers—Two Shipments | |
|---|---|---|---|
| A | DOP | 10,000 pounds | |
| A | TCP | 10,000 " | |
| Monsanto | Santicizer 160 | 10,000 " | Total Cost $9,850 (TL & LTL) |
| | | **One Mixed Tank Truck from Monsanto** | |
| Monsanto | DOP | 10,000 pounds | |
| " | TCP | 10,000 " | |
| " | Santicizer 160 | 10,000 " | Total Cost $9,150 (TT)<br>You Save $700 on 30,000 pounds |

*Costs based on price schedules of February 15, 1956.*



*a new source — a new name for cyclohexanone*


*available now from basic production*



New plant, new product, new high standard of quality . . . that's the quick story of National NADONE. Users everywhere tell us that it makes exceptionally light-colored resins of very high quality.

If you now use or may use cyclohexanone as a solvent or reactive intermediate, we would like you to receive a working sample of NADONE so that you can find out for yourself how fine it really is.

We'll also be glad to send you our 24-page Bulletin I-19, now being printed, giving properties, reactions and a very inclusive bibliography. Use the handy coupon below.

**NATIONAL ANILINE DIVISION**
**ALLIED CHEMICAL & DYE CORPORATION**
**40 RECTOR STREET, NEW YORK 6, N. Y.**

Boston Providence Charlotte Chicago San Francisco Atlanta Portland, Ore. Greensboro Philadelphia Richmond Cleveland Los Angeles Columbus, Ga. New Orleans Chattanooga Toronto

Allied Chemical

*Trade Mark

**Please send copy of Technical Bulletin I-19**

NAME ____________________

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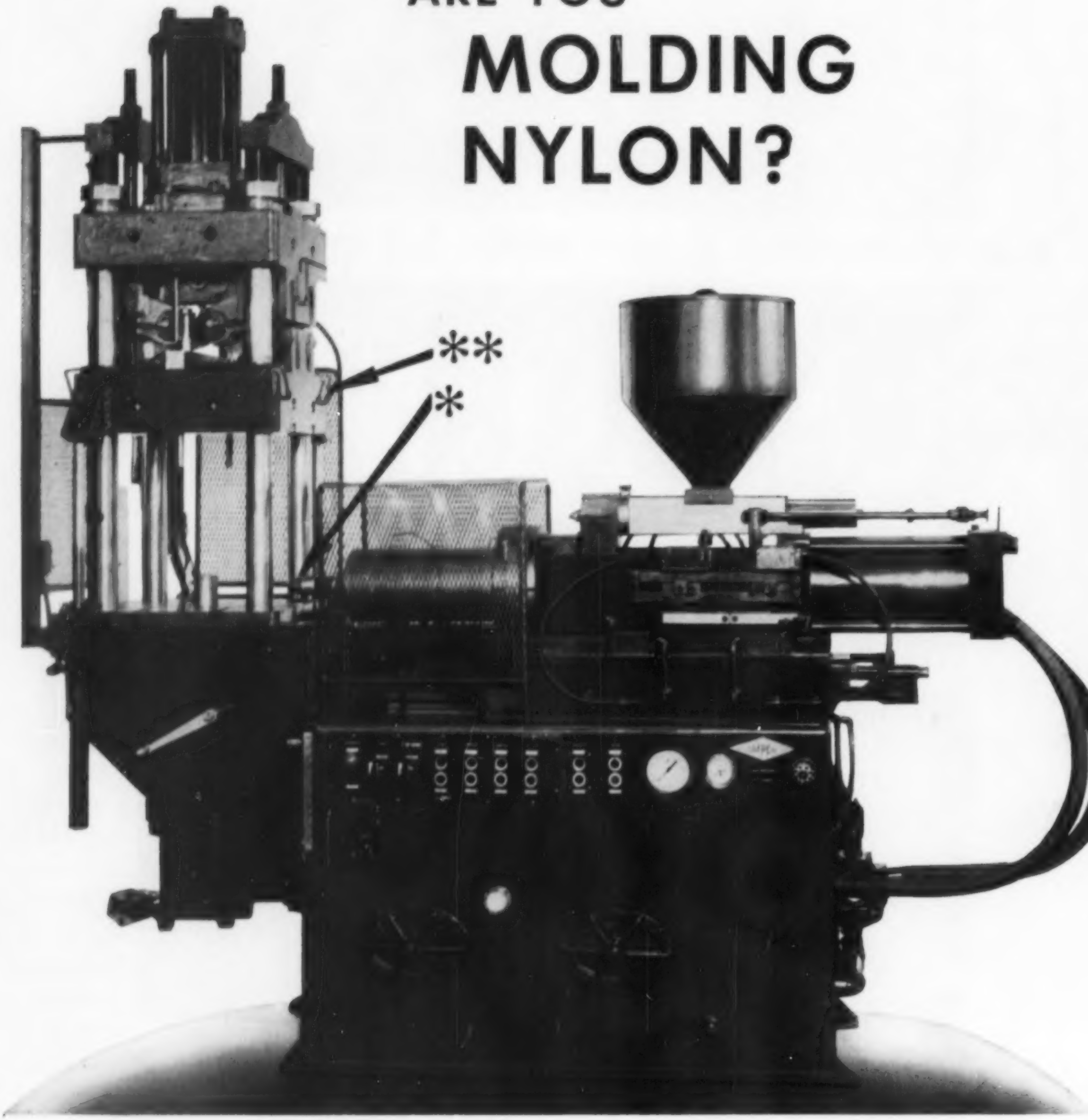
____________________

# ARE YOU MOLDING NYLON?




## IMPCO VA4-175-19 — 4-6 OUNCES

SPECIFICATIONS

| | |
|---|---|
| Injection Capacity | 4-6 oz. |
| Injection Pressure (Plunger) | 21,750 p.s.i. |
| Plasticizing Capacity (Polystyrene) | 75 lbs./hr. |
| Clamp Pressure (Toggle) | 175 tons |
| Clamp Stroke | 8" |
| Die Thickness | Max-14" ....... Min-8" |
| Machine Cycle (Dry Run) | 7/Min. |
| Auxiliary Bottom Ram | 19 Tons |
| Dimensions | Length-102", Height-112", Width-60" |
| Weight | Approx.-9000 Lbs. |

*No drool problem with this easily controlled check valve type nozzle.

**Vertical type press-ideal for insert molding.

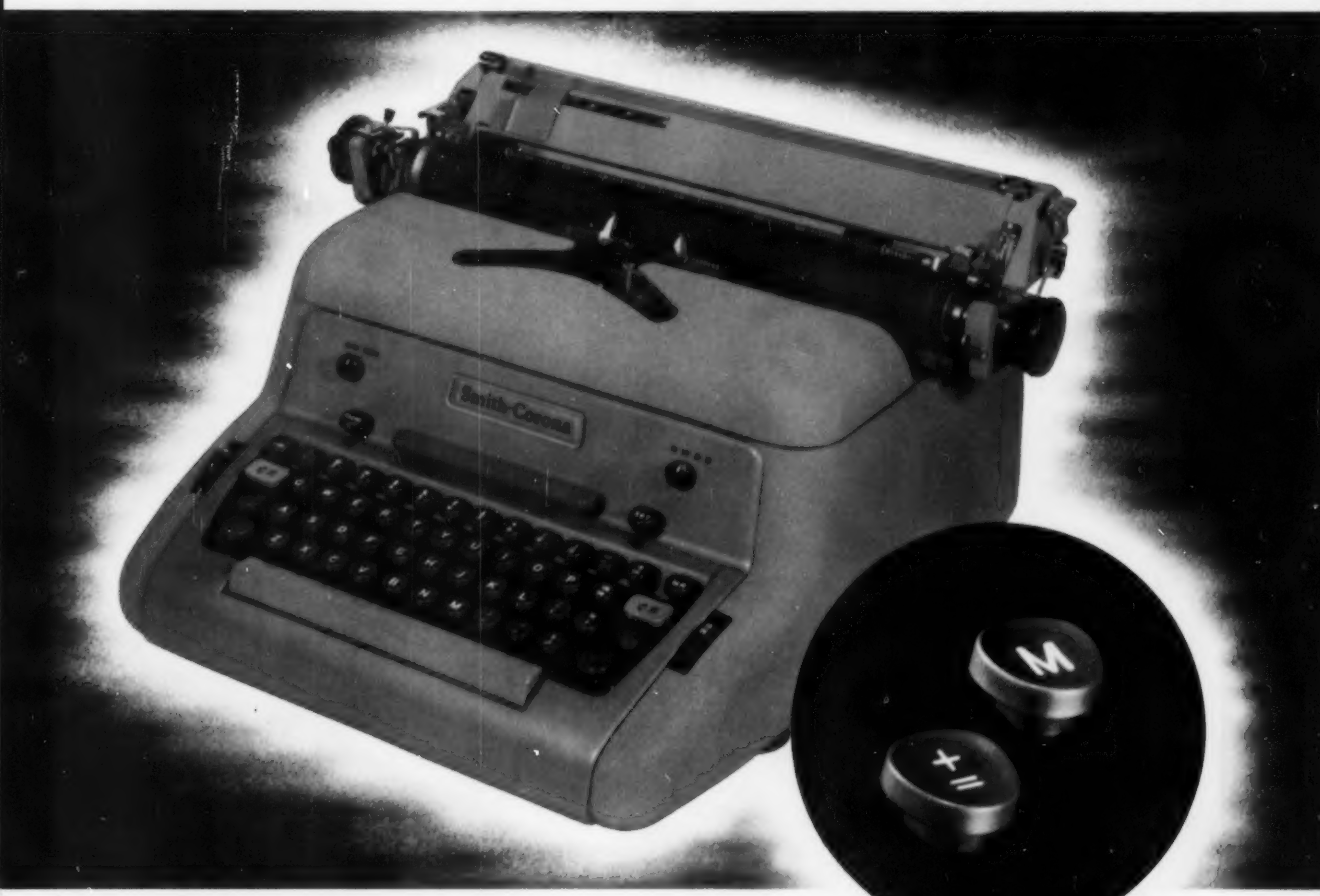
If you are a nylon molder, you must investigate this Impco machine!

IMPCO®

**IMPROVED MACHINERY INC.**
**NASHUA, NEW HAMPSHIRE**

# *Beauty* That's More Than Skin Deep !

## AMERICAN "DOUBLE-SHOT" INJECTION MOLDING




## keeps keys **LIKE NEW** the lifetime of the most durable equipment

**American's DOUBLE-SHOT Injection Molding** *is the ideal way of producing plastic parts with indicia molded in—keys for typewriters, calculators and other business machines—tuning dials—character wheels for registers, speedometers, counters—wheels with cams and gears for special purposes and scores of other applications where permanent indicia is needed.*

Look closely at the keyboard, platen knobs, and other controls on this beautiful Smith-Corona typewriter. Note the clearness of the symbols and numbers. Look again at this same keyboard after years of hard service and you'll see the same "brand new" beauty. You'll find the keys just as brilliant . . . just as readable and indestructible. The secret is below the surface. These parts were formed by American Plastics which has mastered the patented process of Double-Shot Injection Molding.

With this process, letters, numbers and symbols are formed from a separate plastic part, not imprinted or filled in. Get the facts on this surprisingly economical process by *writing direct to American Plastics,* one of America's largest suppliers of Double-Shot Injection Molded parts. Address Dept. BBB.

APC
PRECISION MADE

**AMERICAN PLASTICS CORPORATION**

A Subsidiary of Heyden Chemical Corporation

EXECUTIVE OFFICES: 342 MADISON AVENUE, NEW YORK 17, N. Y.

PLASTICS PRODUCTION PARTNER OF AMERICA'S MOST PROGRESSIVE MANUFACTURERS

# **Angier Products** bond Plastic to Metal

# at *Farrington®* of Boston

# for these Famous Names

*Farrington's handsome new home at the New England Industrial Center, Needham Heights, Massachusetts.*


REMINGTON

Fame came first to our Farrington friends when they applied their automatic spring hinge to a metal case with snap cover for spectacles. That was back in 1904.

Since then *"Packaged by Farrington"* has become a mark of distinction in display cases for watches, jewelry, fountain pens, electric shavers, playing cards, and many other quality products.

As part of their rigid quality control, Farrington selects an Angier Adhesive for the sure bonding of their Texol®* simulated leather to thin sheet steel. Some of the famous products given added sales appeal by this packaging technique are shown here.

**Farrington's trade-marked name for its own simulated leather.*

*Consult an Angier man early with your bonding problem. He represents twenty-five years of custom service for every adhesive need.*

*Write Dept. A for Free Descriptive Brochure*


SHEAFFER'S


GRUEN

**For Every Industry**

Latest developments in Adhesives for
Honeycomb Construction, Vinyl Film Bonding
Rubber, Latex and Resin Cements
Pressure Sensitive Cements, Flocking Cements
Laminants and Sealants
Tie Coats Resin Emulsions

ANGIER PRODUCTS INC.

SWANK

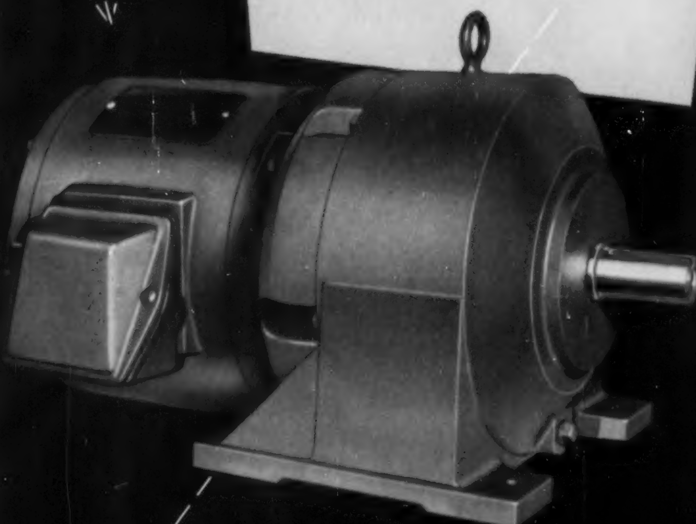
# Angier Products

**120 POTTER STREET, CAMBRIDGE 42, MASS.**

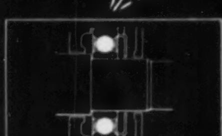
*Midwestern Plant:* Huntington, Indiana


NEW YORK TO LONDON
BY WAY OF 'ALKATHENE'
I.C.I. 'Alkathene' insulates the new transatlantic telephone cable
I.C.I. are proud to have kept the signal flag flying with their contribution to the new transatlantic cable, linking by telephone the New World and the Old.
Submarine Cables Ltd., London, used 'Alkathene' as the insulant in the greater part of the submarine cable now laid—at a depth of up to three miles—from Newfoundland to Oban as the undersea part of the New York-London telephone line.
This is the longest and deepest submarine telephone cable in the world, and will provide for 36 simultaneous conversations when it is completed at the end of 1956.

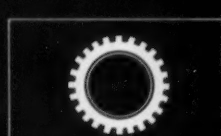
# Don't overlook what you can't see



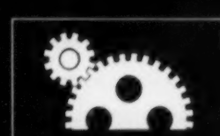
You can't always see what makes a gear-motor outstanding. It's the attention paid to small design details that makes the difference. Here are a few of the details that make the new Reliance Gearmotor stand above the rest.



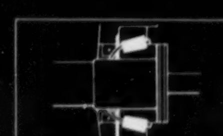
**FOOLPROOF METERMATIC** motor bearing lubrication and oil bath gear lubrication for long-life protection against wear.



**INDUCTION HARDENING** of the tough alloy steel gears gives a perfect combination of wear resistance and strength.



**SIMPLIFIED GEARING** with few moving parts reduces friction losses and lessens chances of breakdown.



**THRUST BEARINGS** handle heavy overhung loads safely by placing strain on the frame instead of the shafts.

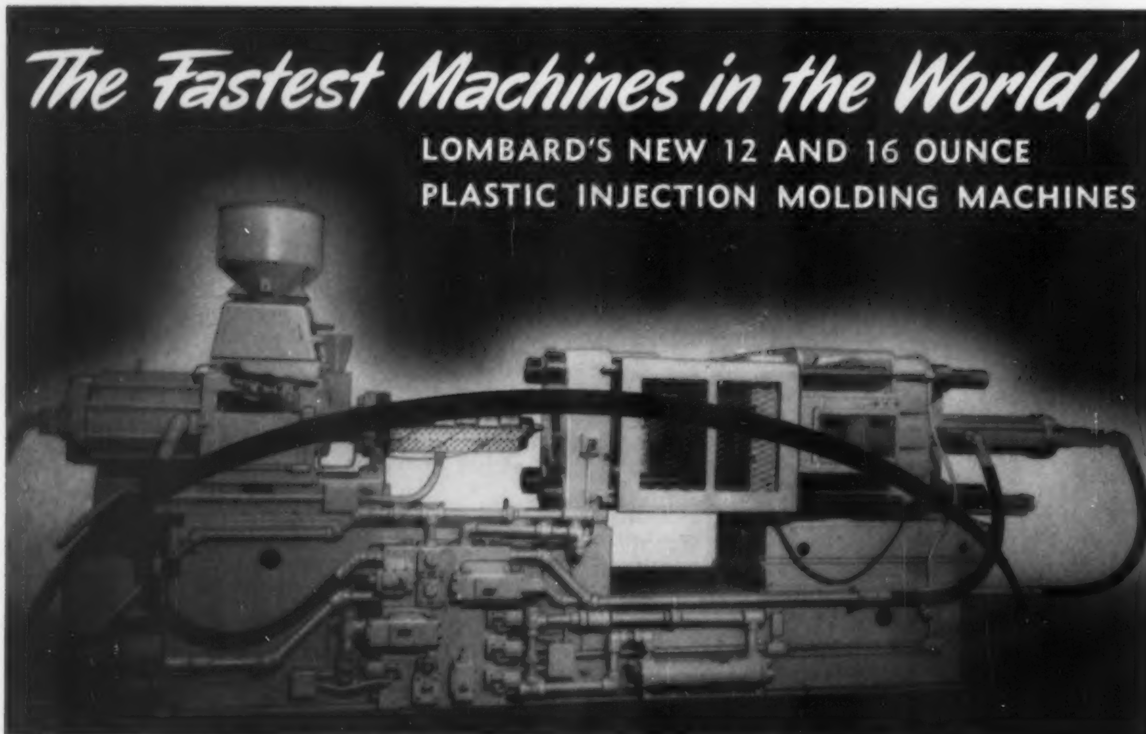
*Find out the complete story for yourself—contact your Reliance representative or write for Bulletin E-2408.*

REDUCE SPEED

**RELIANCE** ELECTRIC AND ENGINEERING CO.

CLEVELAND 10, OHIO • OFFICES IN PRINCIPAL CITIES

Canadian Division: Welland, Ontario

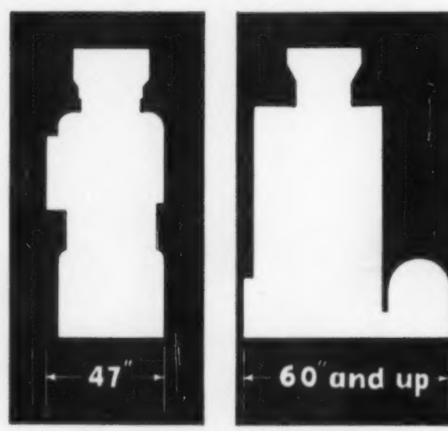



**ENGINEERED FOR ACCESSIBILITY and LOW MAINTENANCE COST**

The Lombard not only gives you faster production, but is designed for low maintenance cost as well. This rear view shows hydraulic valve manifold. Note the simplicity of piping, accessibility to every valve and minimum floor space.

- **GREATER PLASTICIZING CAPACITY** than any other comparable machine.
- **COMPENSATED WEIGH FEED** is standard. Material savings up to 15% possible.
- **WATER COOLED** feed sleeve; eliminates trailing water hose and much maintenance work.
- **LONGER PLATEN STROKES** — Choice of 14" or 20" available for standard or **extra** capacity.
- **CENTRALIZED VALVE** panel gives complete accessibility to every hydraulic valve.
- **AMPLE ELECTRICAL** capacity of each unit, for full power plus protection at all times.

*Write today for more details on the new Lombard Injection Molding Machine that will put you "Years Ahead" in profitable production.*




END VIEW LOMBARD SPACE SAVER

END VIEW OTHER MAKES

# LOMBARD GOVERNOR CORP.

***Injection Molding Division***

**ASHLAND, MASSACHUSETTS, U. S. A.**

*New York Area Sales Representative:* The RAINVILLE Co., 647 Franklin St., Garden City, N. Y.

# "At last! The cavalry's coming!"

Wouldn't you know it? Just when it seemed like them dad-gummed Injuns would lift the scalps of Pappy and Elia Goobish, there come the Cavalry boys! Lucky that only happens on TV these days.

Before you say it aloud, though, answer this: when it comes to moldings, are you a "Pappy Goobish," too?

You are if you have to sweat each job out right down to the wire, not knowing whether your molder will come through just in the nick of time, just like the Seventh Cavalry, or will "lift your scalp" by not meeting specifications or delivery date.

Well, don't despair, podner. There's a Plastics Pioneer who can help you. The name? Why, Dan'l Boonton, of course! Boonton's been working with molding customers for more than 34 years, giving them high-quality injection and compression moldings, delivered on time and at a right price. And it's easy to understand why Boonton can do such standout work: they've got the equipment, they've got the skilled staff, and they've got a heck of a lot of pride in the fine service they give.

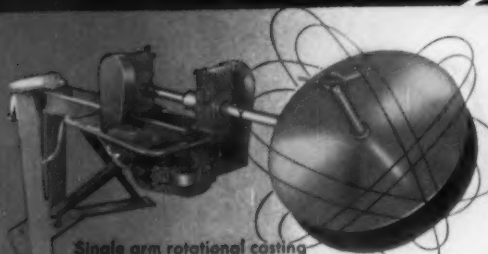
So, next time you have a molding job, make sure your scalp is protected. Hop on a stagecoach and take it to Boonton.

**BOONTON MOLDING CO.**

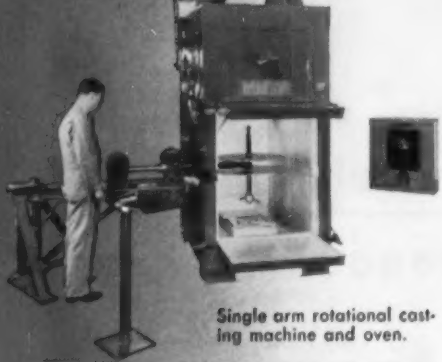
BOONTON, NEW JERSEY

NEW YORK OFFICE—CHANIN BUILDING, 122 EAST 42ND STREET, OXFORD 7-0155

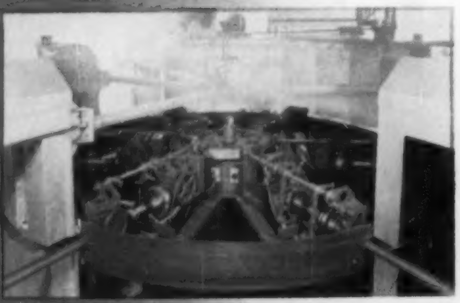
# *Announcing . . .*

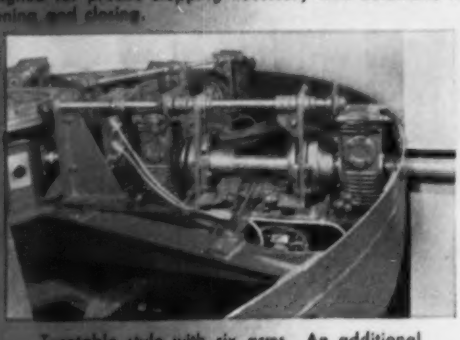
Single arm rotational casting machine with two independent variable speed drives. Automatic positioning of mold wheel for convenient mold servicing.



Single arm rotational casting machine and oven.



Multiple arm casting machine showing separate drive, clutches and brakes for mold rotation in each of the two planes. Designed for precise stopping necessary with automatic mold opening and closing.



Turntable style with six arms. An additional six arms can be added for a total of 12.

## Significant Advance for Rubber and Plastic Production

*Machines engineered and built to your specific requirement. Following are some of the features built in our SPECIAL MACHINES.*

Two groups of molds per arm, arranged for simultaneous rotation around two axes perpendicular with each other.

Two separate and variable speed drives rotate the molds around each axis. This action controls wall thickness for different product shapes.

Movement of arms is indexed for stop and go—not a continuous movement. Stopping time in oven or at the mold's service position can be varied.

Rotation of molds can be automatically stopped or started at service position and oven entrance.

Molds are automatically positioned for convenient opening, stripping, filling and closing.

A 30-inch diameter mold area allows a large range of mold sizes and flexibility of arrangement.

Arms, oven units and service stations can be added to increase capacity and mold servicing.

*Sales and Engineering by*

**HALE and KULLGREN, INC.**

*P. O. Box 1831 · AKRON, OHIO*

MANUFACTURED BY

**THE AETNA-STANDARD ENGINEERING CO., PITTSBURGH, PA.**

PLANTS IN WARREN, OHIO · ELLWOOD CITY, PA.

Turntable style with six arms. An additional six arms can be added for a total of 12.

PLANTS IN WARREN, OHIO · ELLWOOD CITY, PA.


# PITTSBURGH 508 PREFORM ROVING

All of our molding customers who have tried Pittsburgh's new #508 roving report excellent results. That's because PPG #508 really "outperforms" other known types of roving in producing consistently better preforms.

PPG #508 Preform Roving is definitely superior because it has been treated by a special sizing process to insure better chemical and mechanical bond between glass fibers and molding resin. Results: consistently high quality moldings, lower scrap rate, faster preforming.

Check out PPG's new 508 Preform Roving on your own molding jobs and see the difference. You can get complete information on standard packages and available sizes by simply contacting our executive offices or our district sales offices in Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis or Los Angeles. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

FIBER GLASS

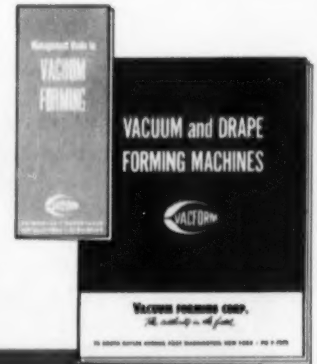
PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

*Send for new reports:*

# VACUUM FORMING

*... what it IS ... what it DOES ... what it SAVES*
*... its ADVANTAGES over other plastics and metal forming processes*
*... its APPLICATIONS in your business*

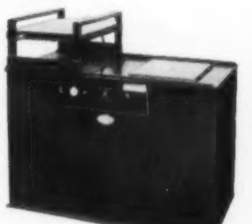



COMPARED WITH CONVENTIONAL MOLDING METHODS

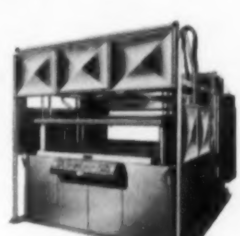
## "VACFORM" SAVES 92% ON MACHINE INVESTMENT 364% ON TOOLING COSTS

Vacuum Forming is a manufacturing process of major importance to every company concerned with molding or fabricating. It drastically reduces capital investment required for equipment and tools. It broadens the range of available raw materials. It enlarges the market for finished products. Frequently, it contributes to an improvement in quality.

You will find these authoritative new guides to Vacuum Forming of great practical value. Write for them today.



*A full-scale vacuum forming machine for less than $1,000. Especially recommended for low-cost pilot runs, experimentation, product development.*



*One of the newest VacForm units (Model 50-30) featuring water cooling and other advanced technical features. Sheets to 52" x 30", draws as deep as 15".*

### HOW VACUUM FORMING IS NOW BEING USED

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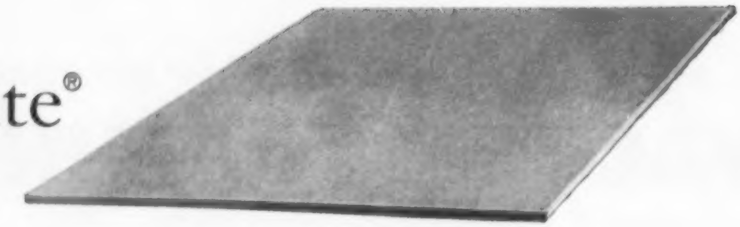
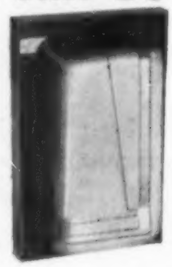


molds to any contour or detail, functional or decorative... can be quickly tooled by means of cast molds



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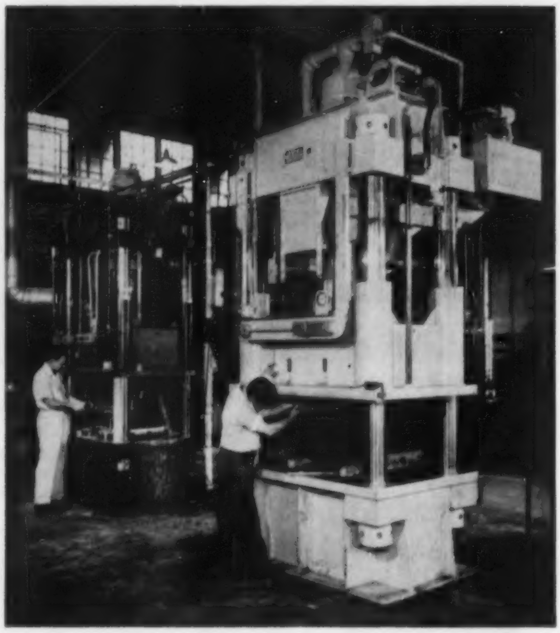
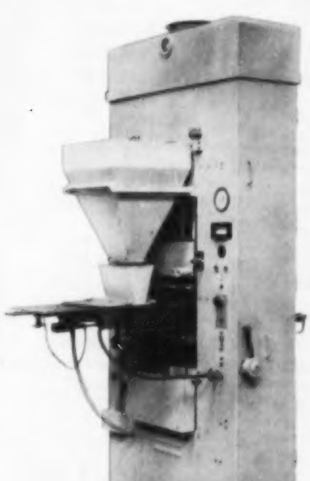


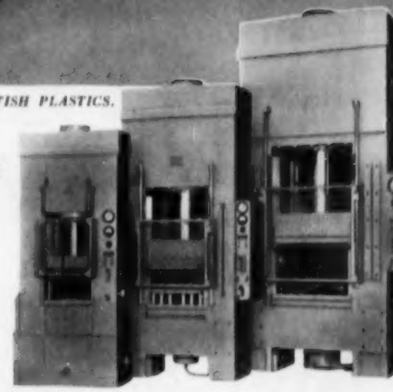
These are two of three Dake Plastics Molding Presses built for a large refrigerator manufacturer. The newest (right) incorporates features that were not considered necessary when the first press was built only 30 months earlier. Thus Dake engineering copes with the rapid advances now being made in the plastics molding industry.

**DAKE CORPORATION,** 648 Seventh St., Grand Haven, Mich.

DAKE PRESSES









# U.S.I. POLYETHYLENE PROCESSING TIPS

## Tailormade resins, a trend for the future

*The nation's leading industrial forecasters predict a polyethylene consumption of 850 million pounds for 1960 — with the billion-plus pound per year goal only a few years away. Although much of this increased production will be consumed by end-products already on the market, many new applications and new developments are expected to arise with the increased availability of polyethylene resin.*

*Polyethylene molders and extruders, long accustomed to working with a limited number of polyethylene types, will exercise increasing influence over the properties of the basic resin. Resin suppliers will work more and more closely with the converters, especially manufacturers of new products, to supply them with resins having the best possible properties for each new application. This is a trend already well established.*

For example, here are a few of the 25-35 PETROTHENE® resins and variations that have already been tailored to specific processing situations and new end-use applications.

**1. INJECTION MOLDING:** Molders want high flow for maximum production, high gloss for appearance, and a choice in degree of flexibility. PETROTHENE 202 and 203 have been tailored for large shot moldings; 200 and 201 for smaller shots and multiple cavity dies.

**2. FILM:** PETROTHENE 110 and 210 are tailormade for blown- and flat-film extrusions. Degree of slip can be controlled to meet customer requirements. PETROTHENE 213 has been selected in specific cases for transparency, hand and high production rates.

**3. PAPER COATING:** Converters want good adhesion, high production rates, resistance to hot-melt oxidation, no odor. PETROTHENE 203 has been tailormade to fit these specifications. It has been accepted by the pulp and paper industry as an improvement in paper-coating raw material and is gaining in popularity for this vital and expanding application.

**4. ELECTRICAL:** The wire insulation manufacturer requires polyethylene that gives stress-crack resistance, low deformation under load, and good all around electrical characteristics. PETROTHENE 300 series has been tailored to these end-use requirements. Type and quantity of antioxidant and color are specified by the customer or by the electrical specification code number.

**5. BLOW MOLDING:** Cube-to-cube uniformity, hot-melt elasticity, clarity — all essential properties for this critical application — have been built into PETROTHENE 201. Other PETROTHENE types have been used in some cases for blow molding because of customers' unusual processing techniques.

**6. EXTRUSION:** PETROTHENE 560 (black) was designed to give good burst strength, high gloss and high extrusion rate for pipe manufacturers.

**7. SPECIALTY APPLICATIONS:** Requests come in for special properties, special forms. U.S.I. has tailored each resin type to fit customer requirements so as to help the converter reach mass production and enjoy greater economies. Thus the converter can obtain his full share of profits from this forecasted billion pound market.

### SUGGESTED PETROTHENE® RESINS

| Application | PETROTHENE No. |
|---|---|
| Blow Molding | 201 |
| Electrical | 300 Series |
| Film | 110, 210, 213 |
| Injection Molding | |
| Large Shot | 202, 203 |
| Small Shot | 200, 201 |
| Paper Coating | 203 |
| Pipe extrusion and misc. | 560 (Black) |

## Do you need a special resin?

If your polyethylene product requires special properties, either in the finished part or during processing, why not call on U.S.I. for assistance. Experienced Technical Service personnel will work with you on every phase of your problem. A U.S.I. PETROTHENE resin, already developed for a similar application, might be just what you need. If not, depending upon the quantity involved, a special resin, tailored to your needs by U.S.I., might provide the answer.

## Tomorrow's prices will encourage new uses

Today's costs of producing quality polyethylene resins are relatively high and constant, but experts feel that as producers improve quality and increase production, lower selling prices will follow. New products, now undreamed of, will be developed within the next few years to utilize the large available volume of this versatile plastic.

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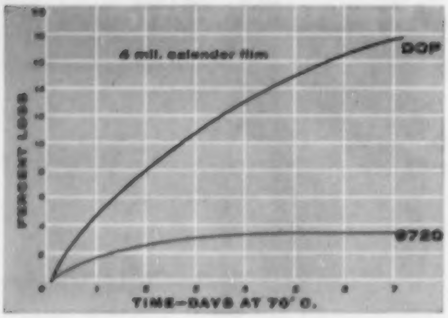
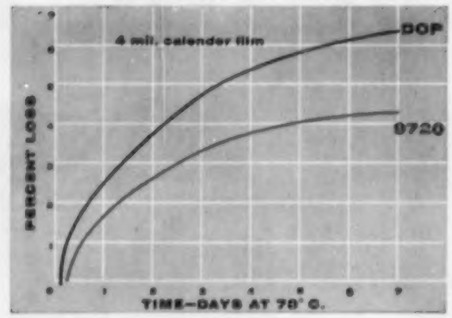
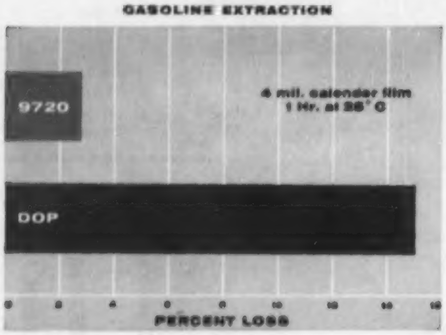



MINERAL OIL EXTRACTION

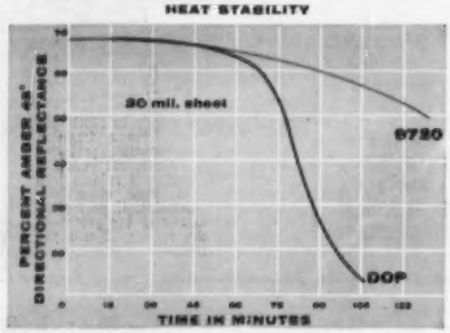



# PERMANENCE

GASOLINE EXTRACTION




HEAT STABILITY

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MODERN PLASTICS

Volume 33
April 1956
Number 8

# Success in accessories

*High-style design features obtainable only in molded and sheet plastics win stable, large-volume markets in fashion field*

Plastics' long-standing courtship of elusive Dame Fashion has been an on-again, off-again affair. Over the years, the capricious whims of the good Dame have sent the fashion world's use of plastics soaring to new heights in one season, only to have it fall off sharply in volume the next. But, despite the fluctuations, the

**Typical** of plastics applications in fashion accessories are shoes with vinyl tops and acrylic heels, necklace-sunglasses set of acetate, and handbag fabricated of vinyl-to-cloth laminate. (Photos, l. to r., Firestone, Celanese, and Bakelite and Fabric Leather Corp.)

**Exclusive styling note** is added to rich-looking vanity case by encrusting it with molded translucent cellulose acetate spheres coated with a sparkling pearl-essence lacquer. (Photo, Celanese)

**Handbags** selling for under $20 are major style market for flexible plastics sheeting. Popular model shown at right is fabricated of acetate printed in an attractive tortoise shell pattern. (Photo, Celanese)

fashion industry has come back to plastics time and time again—and in each instance the over-all volume increase has been higher and the falling-off less drastic.

The dictates of fashion today, particularly in the field of Milady's personal accessories, have again pushed plastics into the limelight—but this time it appears that volume use will still be high at the end of the current fashion cycle. Backed up by improvements in materials formulations, better processing techniques, and more ingenious methods of decoration, plastics accessories have been able to carve a permanent niche for themselves in the billion-dollar fashion field.

It is estimated, for example, that about 20 million lb. of vinyl sheeting alone were used for handbags, wallets, etc., in 1955. Acrylic consumption for the fashionable pencil-thin high heels that are only now entering the initial phases of a fashion cycle was probably between ½ and ¾ million lb. last year. And polyethylene beads, introduced by a leading costume jewelry manufacturer only last year, reportedly have already absorbed close to ½ million lb. of the material.

### Variety of plastics

The fashion accessories industry currently embraces nearly every type of thermoplastic and thermoset, including vinyl, acrylic, acetate, butyrate, nitrate, styrene, polyethylene, melamine, urea, and polyester film. These materials as a group, embody such a wide range of decorative possibilities that they can successfully cut across all the areas of fashion accessories currently serviced by fabrics, leather, and even some of the imitation stones

used in costume jewelry. The range of colors which certain plastics offer is virtually limitless, as is the number of ways in which plastics can be printed, silk-screened, painted, or otherwise decorated. In molded plastics, metallic flakes or pearlescent materials can be incorporated or decorative mottled effects can be obtained in the end product. In sheet form, plastics can be embossed or vacuum formed in an endless variety of surface textures and raised patterns to complement coloring.

Oddly enough, however, in the past few months, crystal-clear plastics have attracted the greatest interest in the fashion field. Transparent handbags, belts, shoes, and shoe heels are currently enjoying unprecedented sales—and this year, the design emphasis being placed on vinyl laminates is expected to expand the market for clear materials even further.

**Low-priced handbags**

Of the various segments of the fashion accessories field, the $150 million (wholesale value) handbag industry is the largest user of plastics, primarily in the manufacture of bags selling for $10 and under. In the $2.98 category, in particular, plastics handbags already are unit volume leaders.

Most of the handbags in this price range are fabricated of vinyl sheeting in gages of 18 to 100. Style-wise, the bulk of the vinyl sheeting presently used in lower-priced handbags is printed and embossed to simulate leather, straw, or other materials; however, the trend is now toward fresh, original designs based either on vacuum forming or on improved methods of simultaneously printing and embossing register.

Vacuum forming, in particular, is of special interest to manufacturers seeking an "exclusive" line. Because of the speed with which a forming job can be tooled up, a manufacturer can get his goods on the market before competitors have a chance of copying them. In addition, the technique has been so refined that three-dimensional detailed patterns, ranging from flower designs to beaded effects, can be accurately produced in quantity.

Embossing and printing methods have also shown considerable improvement. One company, Chelsea Mills, Inc., New York, N. Y., for example, claims to have developed a technique for printing plastic sheet in four or more colors (including metallic gold) and then embossing it to any desired depth so that the colors successfully register on the raised pattern (photos, p. 103).

Also sharing in the lower-priced handbag market, although to a lesser degree, are acetate sheet and pearlescent acetate beads. The beads,

**Rigid laminate** for custom-made, higher-priced handbag is made of ferns locked between heavy-gage sheets of clear acrylic. (Photo, Wilardy Originals)

**Nitrate sheet** is also used in styling of luxurious handbags for higher retail price levels. Model illustrated below is fabricated of silver foil-laminated nitrate sheet stock. (Photo, Hercules Powder Co.)

**Three-dimensional effects** in belt design are achieved by heat sealing vinyl foam between a surface layer of heavy-gage vinyl sheet and a backing layer of thin-gage vinyl sheet. (Photo, Elastomer)

**Belts** padded with vinyl foam and sandals padded with polyurethane foam are kept in popular price category by production economies made possible by using heat-sealing techniques. (Photo, Presto)

which are tied together with colorful vinyl thongs, are used as exterior surfacing (photo, p. 100).

### Higher-priced handbags

Vinyl is also the most popular of the flexible sheet materials used in handbags in the $10 to $20 range. Since a greater degree of exclusiveness is demanded in this area, however, most of the vinyl used is transparent sheet decorated with rhinestones, pearl buttons, etc.

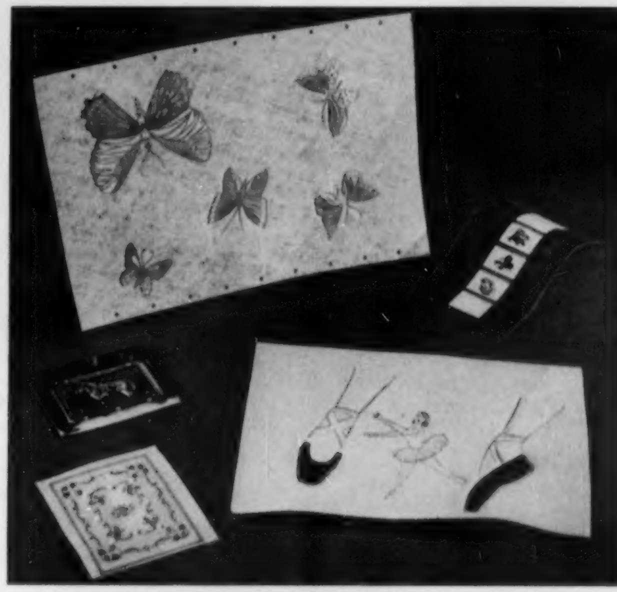
A more recent entry in the handbag field is a polyester film-to-vinyl laminate. According to Coating Products, Englewood, N. J., which already is supplying metallized polyester film to a number of bag manufacturers, the glossy film is especially applicable to the "sophisticated look" so desirable in evening bags.

To achieve even more exclusiveness, manufacturers have adopted other laminates that give the designer even freer rein. Vinyl laminates with "fillers" ranging from fibrous glass to oak leaves already figure prominently in the 1956 styles. One of the newest, made by Dekolam, Inc., Yonkers, N. Y., uses specially prepared butterflies (with colorful wings intact) as the decorative filler (photo, p. 103). Another popular laminate being offered by Fabric Leather Corp., New York, N. Y., has bright summery fabrics laminated between sheets of clear vinyl (photo, p. 99).

In the higher-priced bags, however, which sell for up to $75, the rigid plastics (acrylic in crystal clear, translucent, or opaque, and cellulose nitrate sheet in tortoise shell or mottled

**By varying** thickness and density of foamed vinyl padding in vinyl handbags, resiliency in the end-product can be varied to meet requirements of scalloped, pleated, or quilted patterns. (Photo, Elastomer)

**Improved techniques** for embossing on clear and opaque vinyl and for four-color printing in exact register have opened new areas of application in handbag and shoe fields. (Photo, Chelsea)



**In addition to printing** (top row), plastic sheet can be decorated by painting (left, center), by pasting on ornaments (left, foreground), or by combination with conventional fabrics (right foreground; felt inserted into cut-out shoe areas). (Photo, Chelsea)

**Flexible vinyl laminates,** with filler materials ranging from actual butterflies (left) to oak leaves and grass, figure prominently in modern styling of shoes, handbags, and belts. (Photo, Dekolam)

color effects) account for the bulk of sales. Acrylic is the more important of the two and is currently selling in larger volumes.

Acrylic handbags are generally fabricated of sheet stock in thicknesses up to ⅛ in. and carved by hand. Wilardy Originals, Union City, N. J., for example, one of the pioneers in this field, does all its fabricating, carving, assembly, finishing, and decorating by hand—accenting originality and quality rather than quantity production. Handbags by Wilardy are fabricated of opaque, translucent, crystal clear, or pearlescent materials, and then decorated with rhinestones, metal filigree, or other ornamentation. One line of bags is fabricated of a laminate in which ferns and other materials are locked between sheets of clear acrylic. (Photo p. 101). Another series of square-shaped bags made of pearlescent acrylic has proved so popular that Wilardy is now adapting the idea to the production of luggage-type cases.

**Belts fabricated of vinyl**

Women's belts are in the same basic accessories group as handbags, and styling follows the same general lines. Thus, most women's belts are fabricated of vinyl sheeting, either clear or in simulated leather finishes, and decorated with rhinestones, pearls, flowers, etc.

According to Fabulous Belts, New York, N. Y., one of the companies specializing in belts at the $1 retail level, plastics belts in this price range constitute the bulk of sales—more than all other materials combined. In belts that sell for less than $1, polyethylene is beginning to find extensive use. The polyethylene is ex-

**Delicate silver** or gold filigree designs can be applied directly to molded or fabricated high-style plastics heels (acrylic, acetate, or butyrate) without costly intermediate steps. (Photo, G. M. C. Process)

**Front upper half** of women's dress shoe is fabricated of special press-polished vinyl sheeting in a tortoise shell pattern. The vinyl sheet resists scuffing and scratching and can be wiped clean with a damp cloth. (Photo, Firestone)

truded in flat strips, ½ in. in width and over, with bevelled edges. By changing the profile of the extrusion die, the belts can be stylized in a variety of attractive patterns without raising price out of line with the general market requirements.

In men's belts, where styling within the popular price range is not a determining factor, the use of plastics is nowhere as large as it is in the women's field—although the future holds promise. Some time ago, men's belts fabricated of vinyl sheeting were the rage. A few smaller firms, however, tried to cut costs by making belts thinner and narrower; the plastic belt went out of style. Today, with emphasis shifting to quality production, it is predicted that men's vinyl belts will re-enter the picture.

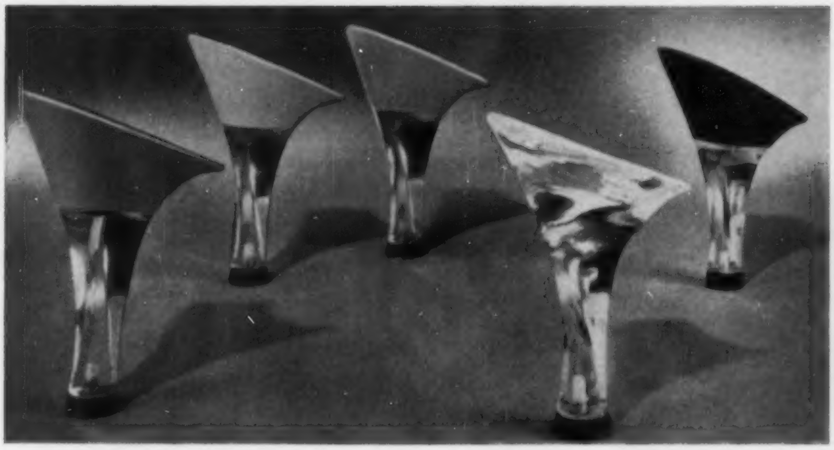
It is estimated at the present time that of the total market for both men's and women's belts (approximately 300 million units are produced a year), over 25% are fabricated entirely of plastics.

**Foamed plastics**

In both handbags and belts, an important recent development is the application of foamed plastics to styling and construction. Elastomer Chemical Corp., Newark, N. J., who licenses the production and marketing of vinyl foams, reports that this material has far-reaching possibilities in fashion accessories.

Specified originally for cushioning purposes, vinyl foam is now being used for creating embossed and quilted decorative effects that strengthen and improve the design, feel, and beauty of handbags and belts (photos, p. 102). Corrugated, scalloped, and pleated patterns, for example, can be created simply by placing foam of the desired density between two layers of vinyl sheeting and fusing the laminate by electronic heat-sealing techniques. A transparent vinyl top layer is sometimes used so that the foam lining shows through as a style feature. Ornaments made entirely of foam are used on handbags, millinery, and dresses; for slip-proof belts, a single layer of foam can be laminated to the underside of a strip of vinyl sheet. Combining vacuum formed film with vinyl foam also presents possibilities.

Presto Mfg. Co., Inc., Brooklyn, N. Y., distributor of fabricated plastic foams is already supplying handbag and belt manufacturers with volume quantities of fabricated vinyl foam. One such company, Better Belts, Inc., West New York, N. J., is turning out an attractive belt consisting of vinyl foam laminated



**Pencil-thin spike heels** which must be strong enough to withstand walking stresses without snapping are either all-acrylic (second from right) or combinations of acrylic and wood. (Photo, United Wood Heel)

**Vinyl welting** extruded in a number of different profiles and shapes and in a wide range of eye-appealing integral colors can be used as up-to-date styling accent in men's shoes. (Photo, Dewey and Almy)

between two sheets of vinyl and heat sealed to give a stitched quilted effect (photo, p. 102). The padded belt, sold in the popular price range, has had excellent consumer acceptance.

### Heels for women's shoes

Plastics entered two basic market areas in women's shoes in 1955—dress- and play-shoes.

In dress shoes the most exciting development from the standpoint of large-volume potential was the all-plastic heel. For some time there has been a growing trend towards pencil-thin spike heels for women's shoes. Wood traditionally used for high heels, is not strong enough when reduced to the diameters required in the styling of such heels.

Taking a cue from the "transparency" fad in handbags and belts, the shoe manufacturers found the answer to their problems in acrylic. This material not only enhanced the delicacy sought by shoe stylists but provided adequate strength in even the thinnest of heels.

Today, it is conservatively estimated, acrylic heels (both in crystal clear and translucent colors) are used on about two million of the approximate 100 million pairs of women's dress shoes sold annually. Now only in its second season, the acrylic heel is here to stay; re-orders already indicate that 1956 is going to be a more successful year than last.

More important, the success of the acrylic heels have made shoe manufacturers extremely plastics-conscious. Acetate and butyrate heels, in smaller quantities, have already followed acrylic into the high-priced dress shoe field—and one manufacturer reports that he is currently experimenting with styrene. Also on tap for the 1956 season are molded nylon heels.

Up to now, plastic heels have been designed to supplement rather than to supplant wood heels. But the emphasis is shifting. One manufacturer is preparing to introduce in 1956 an

injection molded heel (reportedly in the cellulosics family) which will compete with wood in the medium-price shoe range. Other manufacturers are turning their attention to the possibilities inherent in the lower-priced women's work- and play-shoe field, where staple heel shapes and styles can permit them to take advantage of mass-production economies obtainable through injection molding.

#### Machining vs. molding

The acrylic heels can be either machined from rod stock or injection molded. The determining factor is whether or not one style is sufficiently in the fashion picture to warrant investment in a mold. The type of production for which the manufacturer is geared also plays an important role in the final decision.

United Wood Heel Co., St. Louis, Mo., for one, has adapted its wood turning equipment (with only slight modifications) to machining the heels from rod stock suppled by Cadillac Plastic Co., Detroit, Mich. Cast rod was selected for the job because of its attractiveness, weathering properties, adaptability to hand carving, mechanical strength, and machinability. (Photo, p. 105).

Auburn Wood Heel Co., Auburn, Maine, and Haldie Nicholson Co., Leominster, Mass., on the other hand, have found it more economical to injection mold the heels in *(To page 230)*

**Sparkling "gems"** in matching three-piece jewelry set (bracelet, necklace, and ear rings) are molded of melamine and urea. The colorful plastics stones have inherent luster and gloss. (Photo, American Cyanamid)

**Glitter effect** which highlights molded melamine stones for old-fashioned bracelet and ear ring set is achieved by introducing tiny metallic flakes and sparkles into the molding compound. (Photo, American Cyanamid)

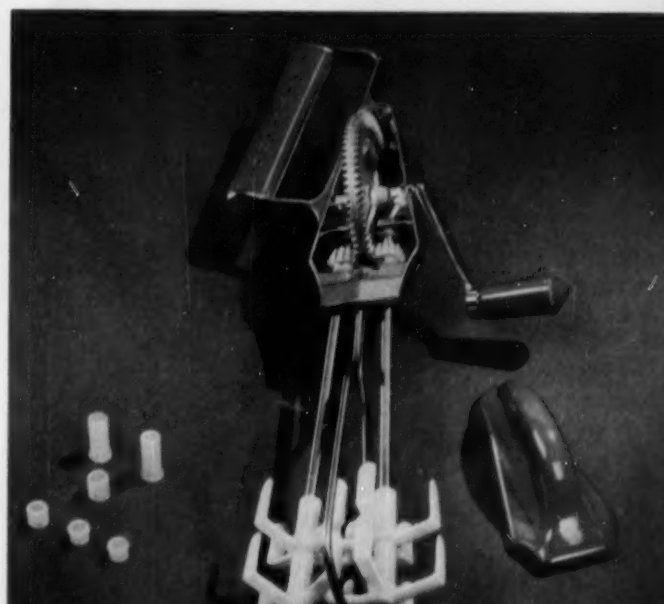
**Stringless polyethylene beads** have molded-in peg on one side and molded-in socket on the other, can be snapped together or taken apart to form bracelets or necklaces of any length. (Photo, Joseph H. Meyer)

# Nylon sells a mixer

*Molded bearings, gears, and beaters in a kitchen accessory give mechanical advantages that can be profitably merchandised*

**Tough beating elements** molded of nylon provide efficient whipping action, are unaffected by hot water, detergents, and greases

**Gears (in housing)** and bearings (left) are also molded of self-lubricating nylon. Housing parts are molded of cellulose acetate



Better performance, greater efficiency, and longer service life have resulted from the use of nylon in the blades, bearings, and pinion gears of a new type of hand kitchen mixer.

Ten mixer components are currently being injection molded of nylon. These include two beating elements, two bearings on each of the steel shafts to which they are attached, two bearings on the crank arm, and two pinion gears which mesh with the main die-cast metal wheel.

According to Maynard Mfg. Co., Glendale, Calif., manufacturers of the mixer, the main reasons for switching from die-cast metal parts to nylon were the self-lubricating qualities of the material and the fact that nylon is unaffected by hot water, soaps, strong detergents, and greases. Nylon also proved itself in other ways. It is lightweight, tough enough to last through years of service, easy to keep clean, and can withstand temperatures up to 300° F.

And because each beating element is molded in one piece, Maynard engineers state that it could be designed in a shape which would provide a highly efficient beating action, but which would be economically impossible to achieve with formed metal blades. A molded-in hole in the center of each double-tiered, eight-pronged beating element permits a force fit for the knurled end of its steel shaft.

Complementing the nylon parts are the tough, colorful, and lightweight molded cellulose acetate gear coverings and handles.

The new mixer sells for $1 more than the former model based on die-cast parts. But so well has Maynard merchandised the functional advantages of the molded nylon components that housewives have been willing to pay a small premium for a superior mixer.

*Credits:* Nylon and acetate parts are molded for Maynard Mfg. Co. by Coast Craft Industries, Glendale, Calif. Zytel 101 nylon is supplied by E. I. du Pont de Nemours & Co., Inc.

# Formed for lighting

*Lamp fixture business reaches profitable new market areas with low-cost plastics shades and diffusers designed around vacuum forming*

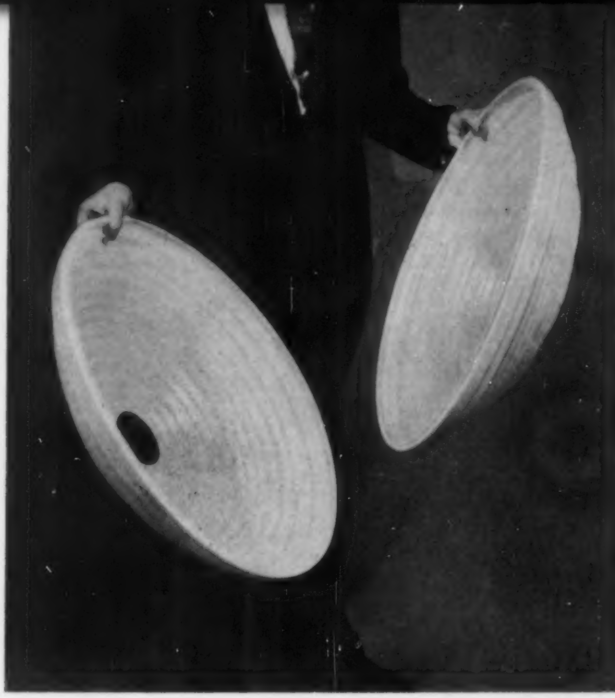
**Fluted shade,** 7 in. in depth and 12½ in. in diameter, is vacuum formed in one piece of tough high-impact styrene sheet 0.045 in. thick

After only two to three years of development work, plastics sheet forming has managed to quietly extend its position in certain segments of the lighting industry to the point where it has become "the tail that wags the dog."

Originally, lighting engineers concerned with designing lamp shades and diffusers had regarded plastics sheet forming techniques as simply a means of complementing in a minor way conventional manufacturing processes based on conventional materials. Today, however, under the stimulus of enthusiastic con-

**Formed styrene** diffuser (left) has curved lip that snaps into rim of shade (center). Clip-on diffuser (right) is also styrene

**By simply changing** hardware, shade can be used for hanging fixture (left, above) or upright (left)



**Rigid vinyl** bubble lamp (above) is formed in two halves (left). Matching undercut sections formed around the top rim of each half snap together for easy assembly. (Photos, Lam Workshop, Inc.)

sumer acceptance, the emphasis has shifted so completely in many instances that a quality lamp house, such as Lam Workshop, Inc., Wakefield, Mass., one of the early pioneers in the field, is able to report that it now considers vacuum forming to be its primary business.

Virtually every one of the many styrene and vinyl shades and diffusers in the Lam line has been specifically designed around the sheet forming technique. In contrast to earlier practices in the industry, Lam engineers are making no attempt to adapt the technique to standard designs conceived for other manufacturing processes. Instead, new forms and new shapes are being devised that can best utilize the design flexibility inherent in vacuum forming.

#### Three new lamps

Heading the list of formed lighting fixtures designed by Lam along these lines are three new plastics models recently put on the market.

The largest of these new shades is a two-piece bubble diffuser, measuring 28 in. in diameter and 15½ in. in depth. Each of the hemispherical halves of the bubble is vacuum formed in an attractive terraced pattern of 0.020-in. translucent white rigid vinyl sheet. To facilitate assembly (the bubble halves can be nested to take advantage of shipping economies), matching undercut sections that snap easily together are formed around the top rim of each half. The interlocking undercut sections also serve to stiffen the bubble diffuser.

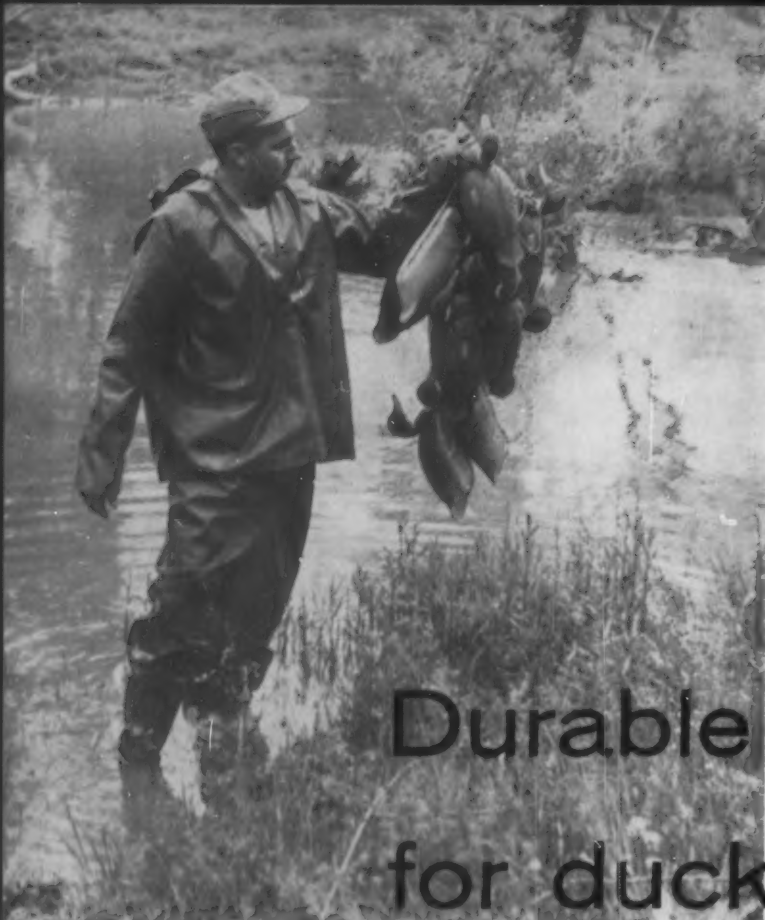
The second, and newest, of the lighting fixtures is a bridge lamp unit formed of high-impact styrene sheet in two pieces—a fluted shade measuring 7 in. deep and 12½ in. in diameter and a flat diffuser which locks into the bottom of the shade to provide shadowless illumination. It is formed of 0.045-in. sheet in an opaque white; the diffuser, through which the light is directed, is formed of 0.030-in. sheet in translucent white. The two pieces are locked together by means of a slightly curved lip formed around the rim of the diffuser and an undercut formed around the bottom rim of the shade.

The third new fixture being made available by Lam is a clip-on-type diffuser 11 in. in diameter, also formed in a terraced pattern of 0.030-in. white high-impact styrene sheet. To reinforce the diffuser without distorting its profile, the edges of the rim are turned in during forming.

#### Vacuum forming procedure

Since abrupt changes in sheet thickness will show up more vividly in lighting fixtures than in other commercial products, the forming job requires particular care and attention. All three pieces are produced on a 24- by 36-in. machine by straight vacuum forming into single-cavity female molds. On the bridge lamp shade, because of its deeper draw from a smaller diameter than the other two pieces, a plug assist is used to push the heated styrene sheet into the mold before the vacuum is drawn.

The models used by Lam for (*To page* 243)



**Vinyl decoys** by the dozen are easy to handle. Tipping the scale at just 1 lb. each, these lightweight decoys faithfully reproduce the appearance of live ducks

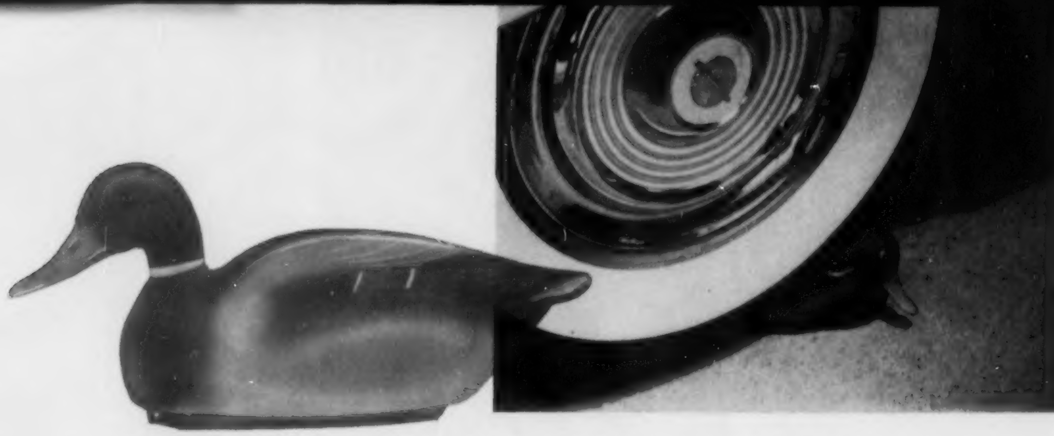
# Durable decoys for ducks

*Light in weight and tough, realistic vinyl plastisol replicas of wild-fowl are produced by rotational molding process*

Working with specially formulated high-Durometer vinyl plastisols, sprayed aluminum molds, and a rotational molding process, McBell Enterprises, Inc., Racine, Wis., is producing a new line of wild-fowl decoys which combine remarkable realism and an amazing ability to absorb punishment without damage.

In tests, McBell's Real-Tuff decoys, run over by a car, immediately spring back into shape unharmed. Extremes of heat and cold pose no problem to them. Such decoys have been plastered with pellets from a 12-gage shotgun at a distance of 30 ft. without taking on water, thanks to the self-sealing quality of the vinyl material used in their construction. The decoys are so light in weight (approximately 1 lb. each) that a hunter can easily hold a dozen of them at arm's length. Deliberately frozen in the pool at McBell's Industrial Park, the decoys have been chipped free for examination and frozen again with no damaging effects from long periods of exposure. Even after being dropped directly upon the beak on a hard surface, the decoys bounce away unscathed.

The life-like coloring of the decoys is obtained by the application of special finishes which are applied after the molding operation. The vinyl plastisol material from which the units are molded is of a light gray color. McBell chemists report that they have perfected vinyl inks and lacquers which, when mixed with solvent, actually penetrate the vinyl, become part of the plastic itself, and provide a completely glare-free surface. In order to insure a life-like appearance in the finished decoys, Fred Sohr, who engineered them and is in charge of production, and Charles Weiss, McBell's supervising artist, went to the Horican



**Run over by automobile wheel,** hollow plastisol decoy springs immediately back into shape, unharmed and good as new. The formulation of which these decoys are rotationally molded, in addition to giving them exceptional resilience, also permits them to be exposed to extremes of heat and cold without ill effects

Marshes of central Wisconsin, where they copied the markings and coloration of actual ducks. As a further touch of realism, the molds were designed to produce both hens and drakes with heads turned in three different directions.

**In one piece**

Molded in one piece by the rotational molding process, the hollow Real-Tuff decoys require no subsequent assembly operations. Through controlled distribution of vinyl material in the mold during the curing cycle, a heavier wall section is obtained in the lower section and keel of the decoys than elsewhere, giving them excellent buoyancy and balance. No weights or secondary operations, such as drilling to insert metal grommets, are required. Molded-in holes on both ends of the keel, which eliminate the need for several manufacturing operations, provide convenient attachment to the stringer.

Although the initial price of the Real-Tuff

**Sprayed with shotgun pellets** at close range, and with some of the shot penetrating its skin, decoy (see close-up at right) does not take on water. Punctures are automatically closed, thanks to the self-sealing properties of the plastisol formulation used in molding the decoy. (Photos, McBell Enterprises)

**Exact model** of decoy is sprayed with low-melting metal (see wire going into spray gun from right) to form one half of mold

**Metered amount** of plastisol is dispensed into one half of sprayed-metal mold. After the second half is bolted to it, the filled mold is ready for the curing oven

**Plastisol-filled molds,** mounted on metal plate, are placed in oven for cure. During curing cycle, molds are rotated in two directions

decoys is somewhat higher than that of their closest competitive quality decoys, the manufacturer believes that their authenticity and durability will more than compensate for the difference. With normal use, it is believed that the decoys should last any sportsman's lifetime.

The specially formulated plastisols used in producing the Real-Tuff decoys are identified by McBell as Rigidsol. They have a 96-Durometer hardness on the A scale, making them ideal for a wide range of products calling for a combination of low cost, high resiliency, and toughness. Although the decoys may soften slightly under exposure to very warm temperatures, and could be distorted if heavy weights should be placed on them under these conditions, as in attic storage, they may be easily reshaped by hand after being submerged briefly in hot water, even though they might have been under pressure for almost a year.

Extremely cold weather causes the keel of the decoys to contract, giving it a slightly concave effect, while hot weather conversely produces a convex shape at the keel. However, neither condition affects the buoyancy or natural look of the decoys as they ride on the water.

**Sprayed metal molds**

In producing the new line of decoys, McBell Enterprises first created exact prototypes of the ducks in wax. Then the hollow metal molds were produced by spraying molten metal directly on the surface of the models, using spray equipment and wire specially designed for this purpose. The wire, a low-melting-point alloy, feeds automatically through the metallizing gun, where it is exposed to an oxy-acetylene flame. A stream of compressed air passing through the gun carries the molten metal particles to the master. Since little heat is retained by the metal particles when they strike the piece, even a hard wax, as well as such materials as metal, cloth, wood, glass or plastics, may be used for the mold prototype of the decoy.

After the two halves of the hollow mold have been built up individually by first blocking off one half and then the other of the original master, and sprayed with an aluminum bronze alloy wire to complete the required thickness, openings are drilled in the perimeter of each half so that they may be bolted and clamped together to form the finished molds. Using this process, a mold suitable for low-pressure, "slush," or rotational molding may be produced in a matter of hours. Such molds are not, however, sufficiently strong for use in compression or injection molding.

**Plastisol metered to mold**

At McBell Enterprises, the liquid plastisol material is then metered through a nozzle into one half of the mold and the other half is clamped in position, forming a hollow cavity whose walls exactly mirror the contours and details required in the finished decoy. Six of the molds, thus charged with plastisol and closed, are clamped on a metal plate which in turn mounts on another plate in the curing oven.

Within the oven, where a temperature sufficient to fuse and cure the plastisol material is maintained, the plate automatically turns in two directions, changing the position of the molds constantly so that the plastic flows to

**At end** of curing cycle, during which plastisol was fused into seamless, hollow casting, molds move from oven to water cooler via roller conveyor

**In water cooler,** closed molds, still mounted on metal plate, pass under streams of cold water. This operation cools the molds sufficiently so that they may be opened and the molded decoys removed

all inner surfaces of the mold, fusing into a hollow, seamless finished casting by the time the cure is completed. The complete oven cycle requires approximately 12 minutes. Emerging from the oven, the molds move via roller conveyor through a water cooler, where a spray cools the molds so they can be opened and the decoys removed. The production process is continuous, with a steady procession of molds moving into and out of the curing oven.

**Masked and painted**

Upon removal from the mold, the decoys are masked and spray-painted to obtain the final colors and markings. In this phase of the operation, aluminum masks are used, produced by the same spray method as are the molds. The accurately fitting spray masks help to insure the excellent color detailing which gives the finished decoys their realistic appearance.

McBell Enterprises, which began its first work in rotational casting of plastisols in January, 1954, is making use of the same production facilities for the molding of various components used by other manufacturers. With the excellent acceptance of the original line of decoys, the company also plans to introduce a line of life-like geese during the coming season. Another product now in production is Real-Tuff, Jr., a soft plastisol duck intended as a child's toy for bath tub, play pool, or out-of-water play.

*Credits:* High-Durometer plastisol material for decoys, Reslac Chemicals, Inc., Div. of The Borden Co., Chicago, Ill., and Watson-Standard Co., Pittsburgh, Pa. Equipment and materials for producing sprayed metal molds, Metallizing Engineering Co., Inc., Long Island City, N. Y.

**Cooled mold** is separated into its two halves and the fully cured plastisol decoy removed. Except for painting, no finishing, trimming, or assembly operations are required

**Vinyl-based finishes,** which penetrate the surface of the plastisol, are used to color the decoys. Accurately fitted masks assure the color detail necessary for realism

# Automotive plastics: 1956

*Second of two articles showing how increasing quantities of plastics are being used by motor car manufacturers*

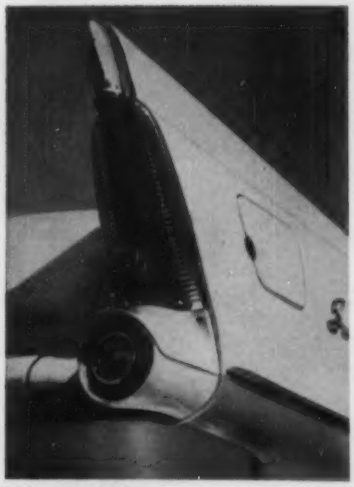
**Wrap-around** rear window on 1956 De Soto convertibles is of heavy-gage cast transparent vinyl, folds compactly when top is lowered

**Perforated vinyl** head lining and sun visors, and vinyl upholstery and trim add style and utility to Chevrolet car interior

The automobile industry produced a record total of some eight million motor cars in 1955 and consumed an average of about 10 lb. of plastics per unit. Output of cars is expected to drop somewhat in 1956. However, as pointed out in March MODERN PLASTICS, new applications of plastics in automobiles should raise the average enough to make possible an over-all poundage increase.

## Vinyls

While practically all the plastics materials are involved, the vinyls hold the volume average, if not the dramatic, spotlight. Acres of vinyl sheeting, vinyl-coated fabrics, and related materials are being used by automotive manufacturers to make car interiors more beautiful, more serviceable, and easier to clean. In the 1956 cars, the versatile vinyls are encountered on every hand—as upholstery materials and trim, as non-reflecting coverings for metal dashboards, and as perforated head linings. In hard working station wagons, many models use vinyl sheeting over wheel wells, on inner door panels, and in other areas to provide smart ap-



**Plymouth**

**Chevrolet**

**Ford**

**Packard**

**Lincoln**

**Molded acrylic** lens material, as the accompanying photos show, provides the automobile designer with a range of style potential for tail-light assemblies not obtainable with any other material. The transparency of acrylic, the integral color, molded-in ribs, reflecting surfaces, etc., all combine to produce the most desirable optical properties in the lens systems used here. Complete integration with overall styling of automobiles is also made possible because acrylic can be molded into practically any shape

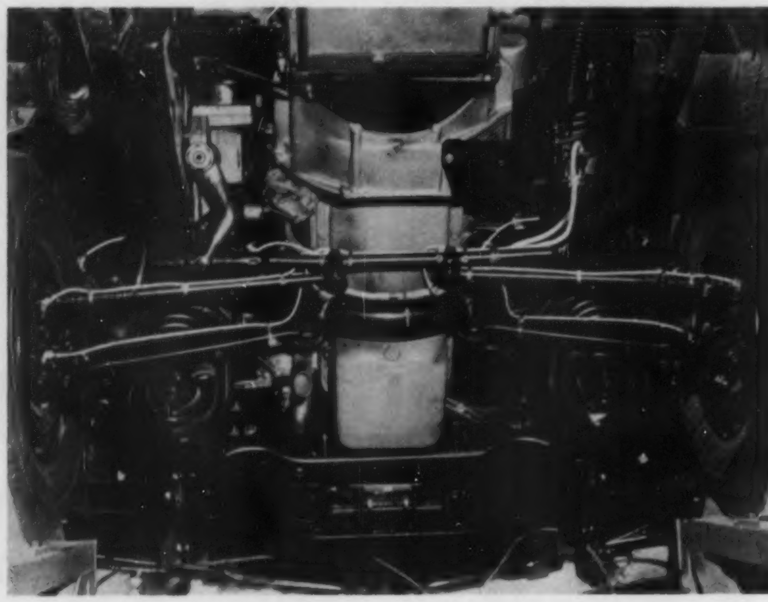
**Nash**

**Chrysler**

**Clipper**

**Door lock wedges** of molded nylon provide vibration damping when door is closed, require no lubrication for proper operation. (Photo, E. I. du Pont de Nemours & Co.)

**One-shot** lubricating system, optional equipment on 1956 model Lincolns, uses extruded nylon tubing to carry grease to approximately a dozen lubricating points



pearance without having to sacrifice serviceability.

The steadily increasing use of vinyl reflects a growing awareness of the fact that, in the past, cars have been much easier to keep clean and attractive on the outside than on the inside. Many upholstery and trim materials soil readily and can not be conveniently washed or cleaned. With the vinyls, ease of maintenance has been achieved at reasonable cost without sacrificing beauty, color, or durability.

A classic example of this important trend is found in the all-vinyl interior of Chevrolet's new Two-Ten Delray coupe. Not only is vinyl used throughout for the upholstery and trim, but the headlining is made of a new perforated vinyl. For a smart decorative touch, the perforated vinyl is carried to the sun visors—a very practical approach, since the visors are constantly handled and, in vinyl, may be easily cleaned. In various other Chevrolet models, as well as in cars of other makes, vinyl bolsters and facings are used in combination with selected fabrics to achieve varied textures and color effects. Also, smart snap-on-type vinyl or vinyl-coated cloth top covers are being used for convertibles.

Vinyl sheeting having a large number of minute perforations, now offered on certain models as upholstery material by several manufacturers, combines the traditional durability, stain resistance, and other desirable properties of the vinyls with air circulation for increased passenger comfort.

### Decorative effects

An almost limitless array of decorative effects is now available in automotive interiors, thanks largely to the many types of grained finishes and other embossed treatments in which vinyl sheeting may be obtained.

Among the many cars utilizing a layer of vinyl sheeting over the metal dashboard to provide a non-marring, non-reflecting surface are the 1956 Lincoln and Mercury automobiles. A number of other manufacturers are also using

vinyl-covered instrument panels, some with supplementary padding for increased passenger safety.

In the new Studebakers, specially selected fabrics are combined into expensive three-dimensional designs matched with the over-all styling in colors and lines. Many Studebaker models are also available in complete two-tone vinyl materials. In the Studebaker station wagons, perforated vinyl handlining with special acoustical properties gives the same quiet sound level as in the company's soundproofed sedans.

### Convertible rear windows

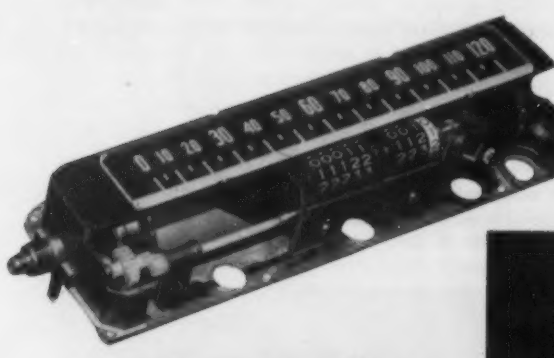
Heavy-gage transparent cast vinyl sheeting, now standard material for rear windows in convertibles, has proved to be ideal for this application because of its light weight, clarity, and flexibility. On the 1956 De Soto convertibles, this material is used to achieve a full "wrap-around" rear window, giving the greatest rearward visibility that has so far been attained in a convertible.

In some of the 1956 Ford station wagons, heavy-gage vinyl sheeting is utilized as a snap-down cover for luggage or other items being carried in the car.

Something new in the way of vinyl applications, making its appearance this year on Ford, Mercury, and Lincoln automobiles, is a vinyl tape which is applied to rear view mirrors to prevent the glass from flying out of the metal frame if shattered by an impact. This new vinyl application, offered as a result of Ford's extensive crash injury research program, should

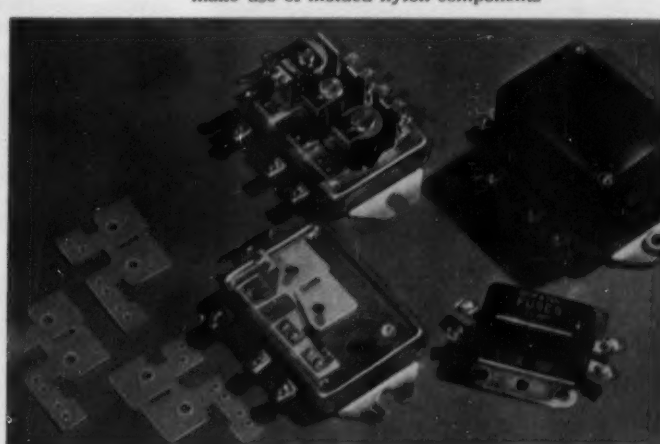
### The rest of the story

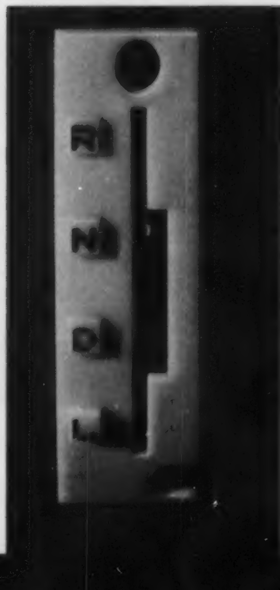
**Latest applications of reinforced plastics, plastics foams, and formed plastics sheet in the automotive industry were detailed in the article starting on p. 89, March 1956 Modern Plastics. The accompanying article completes the story by pointing out the newest uses of nylon, vinyl, acrylic, Mylar, and butyrate in motor cars.**



**Nylon gears** and shafts in speedometer assembly function efficiently and noiselessly—but need not be molded to extremely close tolerances. (Photos, Du Pont)

**In 1956 automobiles,** many electrical parts such as starter solenoids, accessory motors, fuse holders, mounting chassis, etc., make use of molded nylon components






**Molded nylon panel** for dashboard-mounted transmission selector lever combines durability, non-squeaking operation, and good translucency to facilitate lighting

help to prevent many disfiguring passenger injuries.

Although they are not available as standard equipment on the new automobiles, it is interesting to note that seat covers fabricated of heavy gage transparent vinyl sheeting are becoming increasingly popular with motorists desiring to protect their upholstery without hiding it. Some seat-cover dealers report that from one-third to one-half of their current sales is made up of the transparent plastic covers.

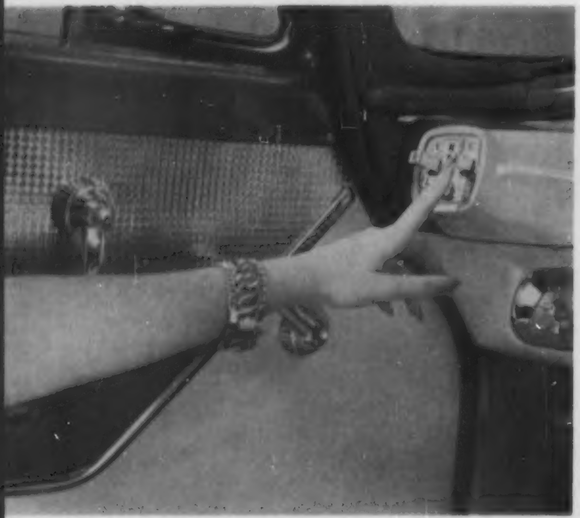
Flexible vinyl windshield washer bags, bonded to a supporting fabric for added strength, have virtually displaced the glass jar container used for many years for this purpose. The new bags are immune to solvents and antifreeze solutions. Even if the water within the container should freeze, the bags will not crack.

## Acrylic

While the vinyl applications in the 1956 automobiles may be listed as the most important from a work-a-day standpoint, the use of acrylic is more spectacular. Thus, when automotive stylists give free rein to their imagination in designing "dream cars" to sample public reaction to new styling trends, they almost invariably include oversized acrylic tail-lights. Since today's dream cars frequently forecast what is to come in tomorrow's production cars, it is reasonably safe to predict that the swing to larger and more functionally designed plastic tail-lights, back-up lights, and parking lights will continue.

Molded acrylic, which in recent years has completely supplanted glass for such automotive applications, has given designers a new and versatile lens material having a host of advantages. Along with its light weight, durability, broad color range, and excellent weather resistance, molded acrylic gives the automotive stylists an opportunity to specify designs which could not be achieved with glass. Molded-in reflecting surfaces, ribs, and other details permit lighting engineers to achieve desired optical properties and at the same time to integrate the appearance of these components with the styling of the complete car.

Size of tail-lights on most of the new cars is not solely a question of appearance. Vital safety factors in today's tight, high-speed traffic, are large and bright tail-lights, back-up lights, and directional signals. It would be literally suicide today to attempt to drive the nation's crowded thoroughfares and superhighways with the small tail-lights of the pre-World War II era. Today, tail-lights must compete with a confusing array of traffic signals, neon signs, and dozens of other lights which have *(To page 236)*

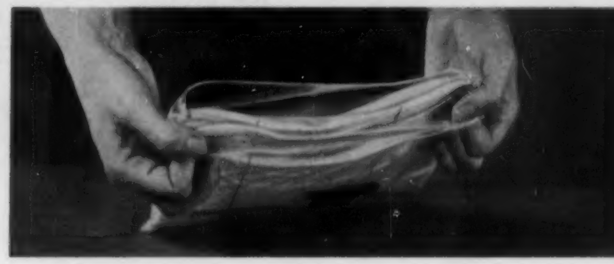


**Door panel trim** of metallized Mylar and butyrate push-buttons for automatic transmission selector are among plastics used in Dodge

**Louvered dashboard outlet** for under-hood-mounted air-conditioning system in 1956 Nash Rambler is injection molded of butyrate, harmonizes in color with interior

**Overlapping cuff** on front side of polyethylene bag flips down easily to provide an efficient package closure. (Photos, The Visking Corp.)

**Package** is readily opened by turning back the flap. No heat seals have to be torn to get at the merchandise



# Flip to close

***Polyethylene bag for merchandising soft goods has cuff closure that can be easily opened or closed***

Product protection and added convenience for shoppers are effectively combined in the polyethylene film packages recently adopted by Munsingwear, Inc., for various apparel items. The "flip-close" bags, as they are called, are now finding increasing acceptance for a number of apparel items and soft goods, since they provide an effective closure which seals out dust and dirt, yet are easy to open.

According to Roger M. Holt, advertising director for Munsingwear, the bags were selected over conventional polyethylene bags for several reasons. Easy closing of the bag after filling cuts down on time and labor required for the packaging operation. Also, the package is neater because of the absence of heat seals at the top or bottom of the bag, which means more attractive dealer displays. The only heat seals present are trim, inconspicuous seams along each side.

The "flip-close" feature of the bag makes it unnecessary to tear or otherwise damage the polyethylene film when opening the bag, giving it more possibilities for re-use in the home and preserving it as an advertisement, since the Munsingwear name is prominently featured on the package. The film used in fabrication of the bag is specially treated to promote permanent adherence of ink, enabling the manufacturer to display his brand name and sales message effectively on the package.

In addition to its unique closure feature, the bag may be easily kept clean and presentable in store displays, since it will not absorb dust and dirt. Also, it has a soft "feel" which complements that of the apparel items packaged and offers a high degree of transparency, enabling prospective purchasers to view colors and other details of the merchandise without removing it from the package.

The "flip-close" feature is made possible by the unusual construction employed at the top of the bag. An overlapping cuff on the front side provides a secure closure in the "down" position, yet can be easily folded back to remove apparel from the package.

*Credits:* "Flip-close" bags fabricated by Bemis Bros. Bag Co., Minneapolis, using Visqueen "C" polyethylene film produced by The Visking Corp., Plastic Div., Terre Haute, Ind.

**Striking display** of tradename and sales message is made possible by treating film for ink adhesion

## Styrene attachment for sewing machine

For housewives who have trouble sewing a straight seam on a sewing machine, a strip molded in one piece of high-impact styrene will serve as a handy guide.

On the face of the styrene strip, which can be attached with two screws to any home sewing machine, is a series of molded-in raised ribs marked off in ¼-in. gradations. When the width of the seam has been decided upon, the seamstress places the edge of the material flush against the raised ridge marked with the desired dimension. By placing her index finger on the material so that it is held taut during sewing, she is assured that she will sew a perfectly straight seam every time.

*Credits:* Sew Strate sewing guide attachment is molded by Kaye Plastics Corp., Stelton, N.J., for Sew Strate Co., Trenton, N.J.

# P L A S T I C S

## Vacuum formed platform inserts for games


Taking advantage of the design versatility inherent in the vacuum forming technique, two new children's games are being marketed in which formed contoured platform inserts hold the playing pieces and also double as integral parts of the games.

Both inserts are formed of tough, lightweight, high-impact styrene sheet. The "Dunce" game insert, for example, is formed in one piece with 17 recesses to accommodate all the pieces used in playing the game.

The "Shake" insert, similarly, has contoured recesses at one end for dice and chips. Also formed into the one-piece "Shake" insert, however, are raised squares which serve as an important part of the game, the top surfaces of the squares being printed after forming with dice numbers.

*Credits:* Vacuum forming by Thunderbird Plastics, Minneapolis, Minn. Styrene supplied by Koppers Co., Pittsburgh, Pa.

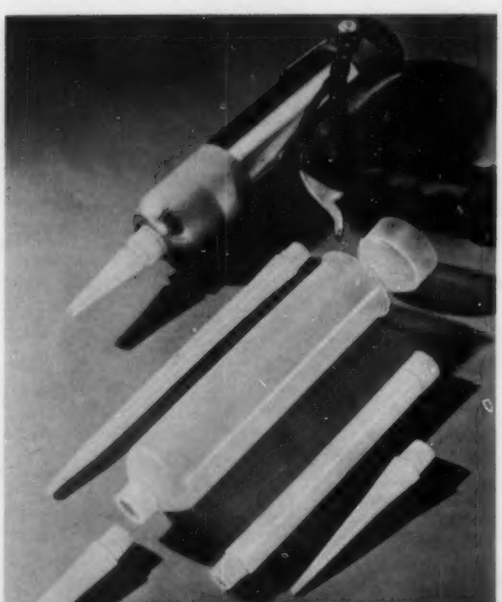
# Clamp holds casting rod in position

Molded polyethylene clamps—rustproof and virtually unbreakable—are designed to keep fishing rods in position while trolling from a rowboat and to hold them safely out of the way when they are not in use.

The flexible clamp fits over the gunwale of the boat; it fits snuggly and requires no screws or bolts to hold it in place. One cradling arm at the top of the clamp holds the rod outboard for trolling. When the rod is not in use, it is fitted into a notch in the inboard side of the clamp which is designed to hold it inside the boat and parallel with the gunwale.

*Credits:* Tenite polyethylene supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.; boat clamp molded by Chili Plastics Co., North Chili, N.Y.; for L. E. Hamel Co., Rochester, N.Y.; distributed by P & K Inc., Momence, Ill.

# PRODUCTS



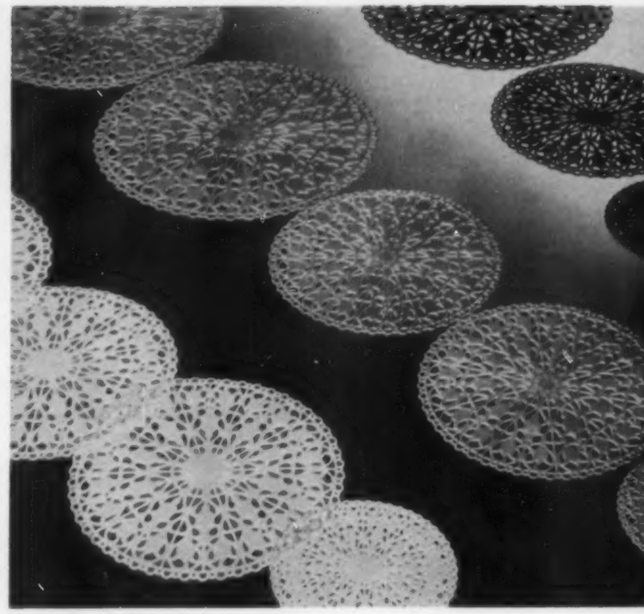
# Polyethylene nozzles and cartridges

Disposable cartridges and nozzles molded of polyethylene make important contributions to fast operation of a new sealant gun used in aircraft and other assembly work.

The cartridges are supplied already filled with caulking compound. In use, one of them is fitted into the barrel of the gun. Then one of the threaded nozzles, available in a variety of sizes and shapes, is screwed into the front end of the cartridge. A trigger in the gun controls the compressed air which forces the sealant smoothly out through the nozzle. When the supply of sealant is exhausted, the polyethylene parts can be discarded to save cleaning time and labor.

*Credits:* Sealant gun, cartridges, and nozzles are distributed by Pyles Industries, Inc., Detroit, Mich. Cartridges and nozzles molded by Variety Plastics, Pasadena, Calif. Tenite polyethylene supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.

# Polyethylene doilies resemble lace

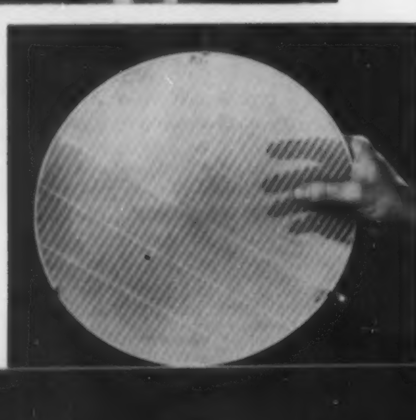


Doilies molded of white polyethylene in an open lacework pattern are as practical for table use as they are decorative. Though delicate in appearance, the flexible doilies have an extremely long service life and can easily be washed or wiped clean to keep their pleasant appearance practically indefinitely.

Available in sizes of 4-, 6-, or 8-in. diameters, the doilies can be used as protective mats under centerpieces, beverage servers, lamps, etc., to prevent marring of wood, leather, or silver surfaces; or as decorative elements that lend an air of elegance to a room.

*Credits:* Produced by Manufacturer's Enterprises Inc., and distributed by Associated Silversmiths, Inc., both of New York, N.Y.; molding is done by R. C. Molding Inc., New Hyde Park, N.Y.; Tenite polyethylene supplied by Eastman Chemical Products Inc., Kingsport, Tenn.

# PLASTICS



# Glare-free lighting with louvered diffuser

Efficient new styrene lamp diffuser which incorporates molded-in louver elements as part of its one-piece design, simultaneously eliminates direct glare and diffuses reading light—all at a cost far below that heretofore necessitated by the use of separate louver and diffuser units.

The elements in the new one-piece unit consist of a series of louvers running crosswise and lengthwise along the surface of the diffuser which faces away from the light. The ribs thus serve not only to minimize glare but also to reinforce the piece. The louvered diffuser is attached to the underside of the lamp shades with three metal clips that snap into place and hold the diffuser securely in position. The diffuser can be used with floor, wall, and desk lamps.

*Credit:* Manufactured by Lightolier Inc., Jersey City, New Jersey.

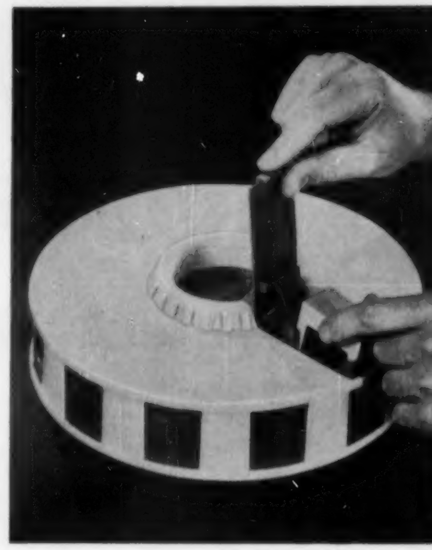
# Case and viewer for 35-mm. photo slides

A rotary storage case and inexpensive automatic viewer, both molded of high-impact styrene, are designed to facilitate storing and viewing 35-mm. color film slides.

The storage case, which shields the slides from both light and dust, is in the form of a covered "lazy susan" tray divided into 12 compartments, each holding 25 slides. The top of the case rotates over the lower half; a lifting bar built into the top swings over the individual compartments and raises the chosen contents for easy removal.

The 5 in. high viewer, which is lighted by a bulb powered by two flashlight batteries, is designed so that each time a spring-loaded trigger is pulled, one slide feeds into the device from a stack at the upper rear. As a new slide comes into view, it pushes the one ahead of it into a storage bin located at the lower front of the unit.

*Credits:* Both items produced by J. & M. Zadiix Products Co., Brooklyn, N.Y. Styrene supplied by Bakelite Co.



# PRODUCTS


## Child's plaything is polyethylene bottle

Blow-molded translucent polyethylene "milk bottles" are the newest fad in playthings for tots from 1 to 3. The flexible bottles are supplied with a set of clothespins which the infant can dump out and then stuff back in—a process that is apparently fascinating to small fry. Since the bottles are unbreakable, they offer no danger to the child playing with them.

A cap is joined by a thin strip of polyethylene, which serves as an integral hinge, to a polyethylene collar that fits around the neck of the bottle, and cannot be lost.

The bottles can also be put to practical use as refrigerator containers for milk, various fruit juices, and similar beverages.

*Credits:* Fill 'n Dump Milk Bottles molded by Injection Molders Co., Kansas City, Mo. for Childhood Interests Inc., Roselle Park, N.J.

# Potting and encapsulation

*By F. G. Firth*

**Potting and encapsulation of electrical assemblies protects them against the actions of air, moisture, fungi, and mechanical shock and frequently improves their electrical performance.**

**The properties of monomer-resin mixtures used and of the cured resins are discussed and compared with those of a hypothetical "ideal" potting resin. The author reviews the chemistry of curing reactions, gives representative structural formulas for the cured resins, and discusses the formulation of sirups for various applications.**

**The practical details of potting by the vacuum method and by the centrifugal method are given in full; advantages and disadvantages of each are presented. The important questions of how and of what materials to make either temporary or permanent molds and of how to obtain clean mold release are considered in detail. A complete "before-and-after" account of the protection of a chain-saw ignition coil is given. Finally, the author explores the future of these techniques.**

It has been estimated that more than 80% of all failures of electrical equipment are due to insulation breakdown. This is the result of voids left during evaporation of solvents from ordinary oleo-resinous and phenolic varnishes. It might be postulated from this that using an impregnant, all of which polymerizes after impregnation, would drastically reduce the incidence of failures, and experience has shown this to be so.

The need for much more dependable impregnation materials and methods has been heavily emphasized by current military specifications on electrical components. They must pass extremely rugged physical and environmental tests under high operational loads. These demands have stimulated the development of special resins and improved techniques of potting and encapsulation. Potting is the deep impregnation and embedment of solenoids, capacitors, resistors, etc., either singly or in assemblies. Encapsulation is the outer protection of such components or assemblies.

The present discussion will deal principally with potting since it is the more important and the more difficult of the two techniques. The application details, resin formulations, and requirements of the two are usually different. Deep impregnation of fine structures requires a low-viscosity resin, while a protective coating on, say, a printed circuit plate, would require a thixotropic material. (A thixotropic material, for the present purposes, is one which flows well while it is being applied and then thickens as soon as brushing or spraying ceases.)

For impregnating tight structures like solenoids wound with fine wire, the following lists give the properties desired in an ideal impregnation resin.

1) The mixed resin should have low viscosity (below 1000 cp.);

**Epoxy-potted** motor armature, sawed in half to show impregnation detail

*Reg. U. S. Pat. Off.

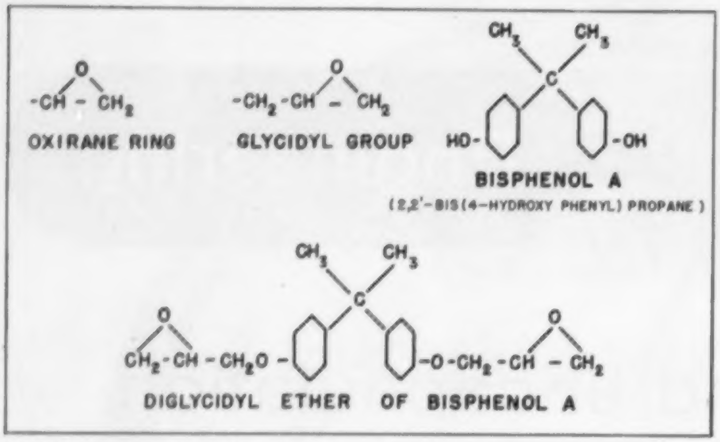



**Fig. 1:** Structural formulas of epoxy-resin constituents

long pot life (more than 4 hr.); a curing temperature below 200° F.; a cure time of 2 hr. or less; no toxicity; good storage life of its components prior to mixing; 100% solids—no solvents or nonreactive materials; a volume shrinkage during polymerization of less than 0.5%; good wettability of surfaces, unaffected by the presence of moisture; no tendency to absorb water.

2) The polymerized resin should have good adhesion to material surfaces; a heat-distortion temperature above 212° F.; a reasonably low coefficient of thermal expansion; good solvent resistance and a reluctance to absorb common fluids such as water, alcohol, fuels, and lubricants; enough toughness to withstand mechanical abuse; good power factor and dielectric strength over the ambient temperature range to be met with; and good arc resistance (see Table I, p. 127).

The requirements for an encapsulation resin would be about the same, except for the mixed-resin viscosity and pot-life characteristics.

At the present time, there is no resin commercially offered that will fill completely all the requirements of the above listing, although some can be formulated which will be close.

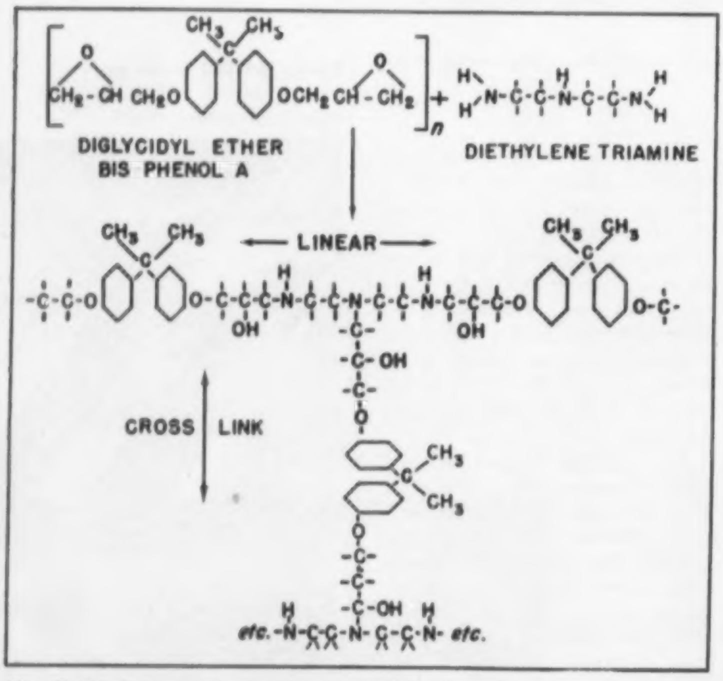



**Fig. 2:** Hardener reaction in epoxy-resin formation

## Available resins

Resins useful for electrical insulation purposes can be listed as either of thermoplastic or thermosetting. Current usage of this terminology is somewhat loose, however, and in practice most of the so-called thermosetting casting resins demonstrate plastic flow at some elevated temperature, while certain so-called thermoplastic materials have a softening point at a still higher temperature (in excess of 600° F. for polytetrafluoroethylene, for example).

All the impregnating sirups listed in Table I can be modified by suitable additions of fillers, diluents, and other monomers, which change considerably the physical, electrical, and chemical properties of the polymer. Wide deviations in the values listed can also be obtained by variations in curing techniques, and by changing the specific catalyst employed.

The heart of the art of potting is knowing what materials should be added to achieve the end result desired. In choosing the base resin, the properties of each of the monomers can be considered separately.

## Phenol-formaldehyde

Phenolic resins are available as thick clear sirups, the viscosities of which will vary with the type of resin and the storage period. They will thicken at a rate which is dependent on storage temperature, and the useful life depends on how viscous a sirup may be used for the particular application.

These sirups are toxic because they contain free phenol and free-acid catalyst. Both attack the skin and phenol is rapidly absorbed into the human system; formaldehyde can also be distressing to the operator by causing dermatitis.

The time needed to cure phe-

nol-formaldehyde sirups must be relatively long to permit the escape of water and other vapors. The water vapor and the acid catalyst can severely corrode delicate electrical components, with resultant loss in electrical performance. The physical properties are generally satisfactory for most purposes.

**Allyl resins**

The main drawback in the use of allyl resins is the excessively long cure time required, and the high shrinkage in polymerization.

**Polyesters**

"Polyester" is a generic term for a wide variety of resins of differing composition and degrees of saturation. They vary in reactivity and yield polymers ranging from rubbery to hard and brittle. The material commonly used in electrical applications is a reaction product of unsaturated polybasic acids, such as maleic or phthalic, with a polyhydric alcohol, such as glycerol. The resin is dissolved in differing concentrations in a liquid monomer such as styrene to form the polyester sirup. An inhibitor such as hydroquinone is added to prevent spontaneous polymerization of the styrene.

The response of polyesters to a given catalyst can vary widely with the resin composition and degree of polymerization as well as with the type of catalyst and its concentration in the reactive monomer. The presence and concentration of an inhibitor will also influence response.

For repetitive plant operations requiring precise and fixed curing conditions, fixed catalyst composition and concentration are desirable but difficult to attain. Not only does the make-up of the polyester resin vary from batch to batch, but a given batch varies from month to month during storage. Accurate control of production quality requires periodic laboratory checks of the polyesters, and adjustment of the amount of catalyst.

If the total solids content of the polyester sirup is lowered too much by adding styrene monomer to reduce viscosity, the shrinkage on curing tends to become dangerously high, and delicate components such as glass vacuum tubes may be crushed. Obtaining really good electrical and mechanical properties in polyester polymers requires a judicious choice of resin, catalyst, additives, and curing conditions.

Corrosion of components by the uncured sirup is usually negligible, although the solvent action of styrene can soften some types of insulation. Wetting of surfaces is not very good and may cause difficulties in some cases. Toxic conditions, which can be quite severe, are due mainly to the breathing of fumes of the monomeric styrene. It is especially dangerous to heat the polyester sirup for curing without adequate ventilation.

Dermatitis can also be caused by the habitual handling, without proper hygiene, of polyester sirups. The sirup should not be allowed on the skin, or used without adequate ventilation.

**Acrylic resins**

The acrylic resins are available as a series of monomeric esters of methacrylic acid. Their polymerization is catalyzed by peroxides and proceeds rather slowly. The main drawbacks to their commercial use as potting resins are their long cure times, high shrinkages, and low heat-distortion temperatures.

**Epoxide (epoxy) resins**

The epoxy sirups available vary in viscosity from fairly thin liquids to high-melting-point solids. They are usually condensation products of epichlorohydrin and bisphenol, the different grades being made by using different ratios of the reactants and/or modifying the conditions of the reaction. For instance, if the mole ratio of epichlorohydrin to bisphenol is reduced from 2.0

(*To page* 130)

**Table I: Properties of potting resins**

| *Impregnating sirup* | *Viscosity* cp. | *Storage life* Mos. | *Curing temp.* °F. | *Curing time* Hr. | *Vol. shrinkage* % | *Type of catalyst* | *Possible sources* |
|---|---|---|---|---|---|---|---|
| Phenol-formaldehyde | 2000-50,000 | 1-6 | 120-180 | 6-48 | 5-20 | Acid | Durez Plastics & Chemicals, Inc.; The Marblette Corp.; Bakelite Co. |
| Allyl | 15-100 | 4-12 | 150-212 | 48 | 8-13 | Peroxides | Columbia-Southern Chem. Corp.; Shell Chemical Co. |
| Polyesters | 500-20,000 | 1-12 | 70-300 | 1-12 | 5-20 | Peroxides | Bakelite Co.; Naugatuck Chemical Co.; Rohm & Haas Co. |
| Styrene | 50-20,000 | 1-6 | 100-200 | 10-25 | 8-20 | Peroxides | Emerson & Cuming, Inc.; The Dow Chemical Co; Monsanto Chemical Co. |
| Acrylics | 4-100 | 1-6 | 100-160 | 24-50 | 10-20 | Peroxides | Rohm & Haas Co.; Du Pont; Bakelite Co. |
| Isocyanates | 20-1000 | 12-24 | 70-200 | 1-12 | 0.5-1 | Condensation | National Aniline; Mobay Chemical Co. |
| Epoxy | 1000-20,000 | 24+ | 70-400 | 1-4 | 0.5-2 | Tert. amines | |
| | | | | | | Condensation | Shell Chemical Corp.; Bakelite Co.; Ciba Co., Inc. |
| | | | | | | Anhydrides | |
| Silicones | 5000-20,000 | 6-12 | 300 | 2-20 | 1-2 | Amines | |
| | | | | | | Condensation | Linde Air Products Co.; The Dow Chemical Co. |

| *Cured resin* | *Specific gravity* | *Tensile strength* p.s.i. | *Compressive strength* p.s.i. | *Arc resistance* sec. | *Dielectric constant* | *Dielectric strength* v./mil | *Rockwell hardness* | *Heat distortion temperature* °F. | *Power factor* at 60 cy. | at $10^6$ cy. |
|---|---|---|---|---|---|---|---|---|---|---|
| Phenol-formaldehyde | 1.30 | 5000 | 12,000 | 100 | 5-6 | 130-230 | M 70-110 | 240 | 0.33 | 0.05 |
| Allyl | 1.3 | 5000 | 20,000 | 100-200 | 3.5-4 | 200-400 | M 90-100 | 150-180 | 0.02 | 0.01 |
| Polyester | 1.0-1.4 | 6000-10,000 | 25,000 | 120 | 2.5 | 200-500 | M 70-100 | 100-400 | 0.003 | 0.005 |
| Styrene | 1.05 | 6500 | 13,000 | No track | 2.59 | 600 | M 80 | 160 | 0.00098 | 0.0008 |
| Acrylics | 1.18 | 10,000 | 13,000 | No track | 3.5 | 300-500 | M 80 | 150 | 0.05 | 0.02 |
| Isocyanates | 1.4 | 1000 | (no rupture) | No track | 2.86 | 360 | Shore 90 | Flexible | 0.003 | 0.008 |
| Epoxy | 1.2 | 12,000 | 16,000 | 100-180 | 3.5 | 380-400 | M 80-100 | 180-310 | 0.001 | 0.02 |

to 1.2, the softening temperature of the resultant sirup rises from 105° F. to 234° F. and the molecular weight increases from 450 to 1400.

Chemically, the sirups can be considered as mixtures of glycidyl ethers of a polyhydric phenol.

Epoxide monomers, if correctly made, have an indefinite storage life. The diglycidyl ethers commercially available are generally non-toxic and non-hygroscopic. The curing time (which is short) and the rise in temperature during curing can be controlled by proper choice of catalyst selection and by addition of other materials, within wide limits. Shrinkage is low and adhesion to surfaces on cure is outstanding as are also the toughness and solvent resistance of the polymer.

The epoxy resin that is commonly used for electrical potting and encapsulation is a low-molecular-weight liquid resin averaging approximately two available epoxy-forming groups per molecule.

The ideal theoretical structure is shown in Fig. 1, p. 126, and, as can be seen, the epoxy oxygen is at opposite ends of a chain structure. Linear polymerization can take place by opening the oxirane ring with an active hydrogen to form an intermediate compound with an -OH group, which can then be further linked under suitable conditions. The active hydrogen is initially supplied by either a hardener or catalyst, depending on the system employed.

A hardener system for an epoxy resin is a copolymerization agent, usually a primary diamine, polyamine, or acid anhydride, that reacts with the epoxy and condenses to form part of the polymer structure.

A catalyst for an epoxy is regarded as an electron acceptor, but it does not become part of the polymer. Such materials are tertiary amines, acid halides such as boron trifluoride, and alkali-metal bases such as sodium hydroxide.

Hardener systems are more useful than catalyst systems, since they make possible a more complete cure and leave no residual highly active, ionic materials to upset water-absorption and electrical properties.

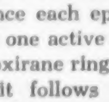
A simplified example of how such a hardener can be used with a low-molecular-weight epoxy follows:

Assume the epoxy resin to be a liquid resin, such as Bakelite ERL 2774, or Shell 828. Published data give the molecular weight as about 390. Assuming two epoxy oxygen groups per molecule, the epoxy equivalent would be 390/2 =195 g. resin per gram-atom of epoxy oxygen.

The hardener can be a primary diamine, for example, such as diethylene triamine (DETA) which can form polymers according to the scheme in Fig. 2, p. 126. This compound is a thin liquid with a molecular weight of 103.2. It will be seen that there are five hydrogen atoms attached to the nitrogen atoms, four of them primary and one secondary. However, they can all simply be regarded as active hydrogens; thus DETA has a functionality of five.

By dividing the molecular weight by the functionality, the hydrogen equivalent of 20.6 g. is obtained. Since each epoxy oxygen requires one active hydrogen to open the oxirane ring for polymerization, it follows that one epoxy equivalent can be completely taken care of by one hydrogen equivalent. Thus 195 g. of epoxy should require 20.6 g. of DETA for complete cure. Or, as the equivalence is more commonly expressed, 100 parts of resin require 10.6 parts of DETA for their stoichiometric cure. Such an exact cure is never obtained, but in some cases more than 99.5% of the reactant groups are utilized.

For higher-temperature physicals and better electrical properties than can be obtained with an aliphatic diamine such as DETA, other systems can be employed using aromatic diamines, such as metaphenylene diamine (MPD), which has the structure




The stoichiometry used for the aliphatic diamines can be used with good results with the aromatic diamines. In practice, the simple aliphatic diamines are

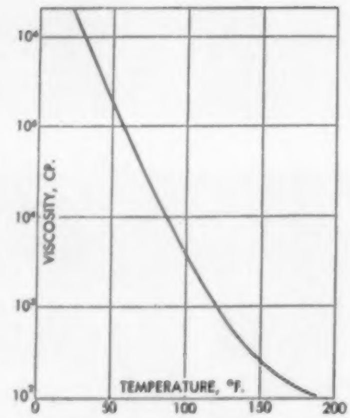



**Fig. 3:** Viscosity of epoxy potting resin *vs.* temperature. Note logarithmic scale at left side of graph

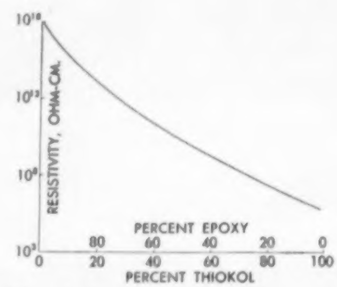



**Fig. 4:** Electrical resistivity of mixed epoxy and Thiokol resins

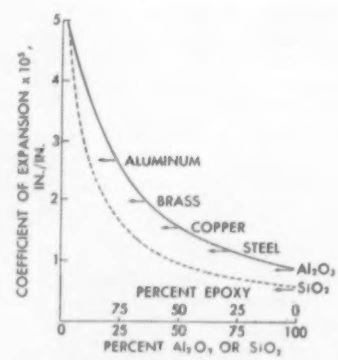
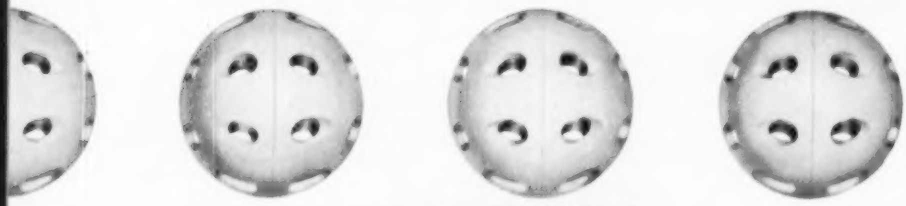


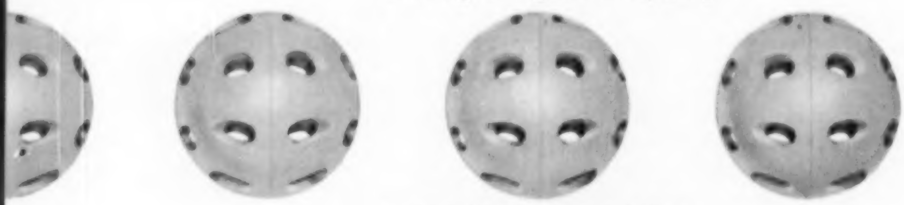

**Fig. 5:** Linear coefficient of thermal expansion of alumina- and silica-filled epoxy resins. Arrows point to values for common metals. A 50% alumina-filled resin, for example, would have a coefficient of expansion which is about equal to that of copper

# TO COLOR POLYETHYLENE



**EFFECTIVELY**

The right degree of opacity

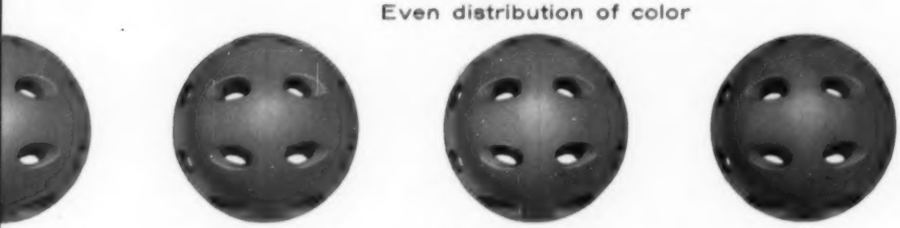


**ECONOMICALLY**

Inventory is reduced by doing your own coloring

**UNIFORMLY**

Even distribution of color



**BRILLIANTLY**

An unmatched range of sharp colors

## SPECIFY TENITE POLYETHYLENE COLOR CONCENTRATES

Tenite Polyethylene Color Concentrates offer molders and extruders a clean, quick and sure way to color polyethylene. Use of Tenite Polyethylene Color Concentrates eliminates the messy handling of dry pigments, color contamination and color uncertainty. In these concentrates, the colors are pre-dispersed in polyethylene. This provides uniform color throughout your molded product with no chance for pigment agglomeration. To extruders of polyethylene film this means complete freedom from the "freckles" encountered with dry colorants. For more information, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

**Local Tenite representatives** are listed under "Plastics—Tenite" in the classified telephone directories of the following cities: Chicago, Cleveland, Dayton, Detroit, Houston, Leominster (Mass.), Los Angeles, New York City, Portland (Ore.), Rochester (N.Y.), St. Louis, San Francisco, Seattle and Toronto—elsewhere throughout the world, from Eastman Kodak Company affiliates and distributors.

Polyethylene practice golf balls shown above were molded by TIGRETT INDUSTRIES, Chicago, Ill., and colored with Tenite Polyethylene Color Concentrates.

toxic and difficult to handle, while on the other hand the aromatic diamines are solids and must be melted and kept molten during incorporation in the resin. (MPD melts at 145° F.) A considerable amount of effort has been expended on this problem, and several satisfactory, low-toxicity, liquid hardeners of both the low-temperature and aromatic types are now available. The solid epoxy resins available are longer-chain monomers with low-epoxy equivalents and many -OH groups along their chains. Since the mechanism of their cross-linking must depend much more on these -OH groups than on the epoxy groups, different type hardeners are needed.

Active hydrogen from an amine is not useful in such a case; instead, dicyandiamide and anhydrides are more effective.

The epoxy resins have proved to be the most generally satisfactory potting material for industrial purposes, and some aspects of their use will be considered.

## Viscosity

For thorough impregnation of the voids in closely packed components such as fine wire coils, the viscosity of the impregnating resin must be low.

Since the non-compounded resins have viscosities at room temperature ranging from about 80 to 1000 poises, it is sometimes desirable to reduce the viscosity by adding certain thin liquids. Some of these liquids are non-reactive, compatible plasticizers, such as tricresyl phosphate or dibutyl phthalate, or simple solvents, such as toluol or xylol.

Best results are obtained by using a reactive diluent that takes part in the polymerization either by copolymerizing with the epoxy resin, or by polymerizing by itself.

Such diluents include certain monoglycidyl ethers, such as allyl glycidyl ether and phenyl glycidyl ether, styrene oxide, butadiene monoxide, epichlorohydrin, acetonitrile, and others. The usual limit of diluent addition is not more than 15% of the resin weight. Beyond this figure some of the diluents mentioned are fugitive and are apt to make the cured resin brittle after a period of time. The addition of appreciable percentages of most of the diluents will also lower the softening point, the water and solvent resistance, the electrical characteristics, and the low-temperature impact strength.

Another pitfall to avoid is the use of reactive diluents that dissolve the enamels and other electrical insulations in the assembly being potted. Unfortunately, most of the materials listed above do have such solvent powers in varying degrees. Attention should be also paid to the vapor pressures of such reactive diluents, so that during vacuum impregnation the bulk of the diluent will not end up in the vacuum condenser or worse, in the pump, where it can gradually polymerize.

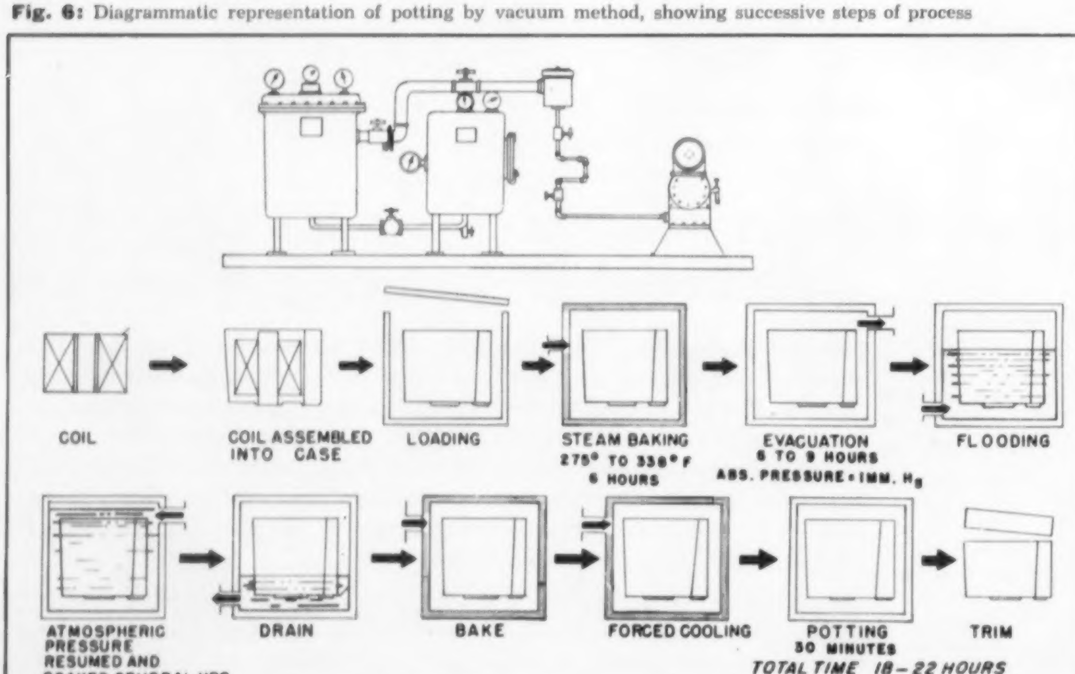
Care should be used in choosing a reactive diluent since they are all extremely active, often very toxic, materials with low flash points. An excellent low-viscosity resin with a non-toxic and compatible reactive diluent is offered by Bakelite as ERL 2795 and by Shell as Epon 815.

The best viscosity reducer is heat. The curve of Fig. 3, p. 130, shows effect of temperature on viscosity of a liquid epoxy resin.

## Fillers and modifiers

Fillers are added to epoxy electrical resins for the following reasons: to lower cost, to improve

**Fig. 6:** Diagrammatic representation of potting by vacuum method, showing successive steps of process



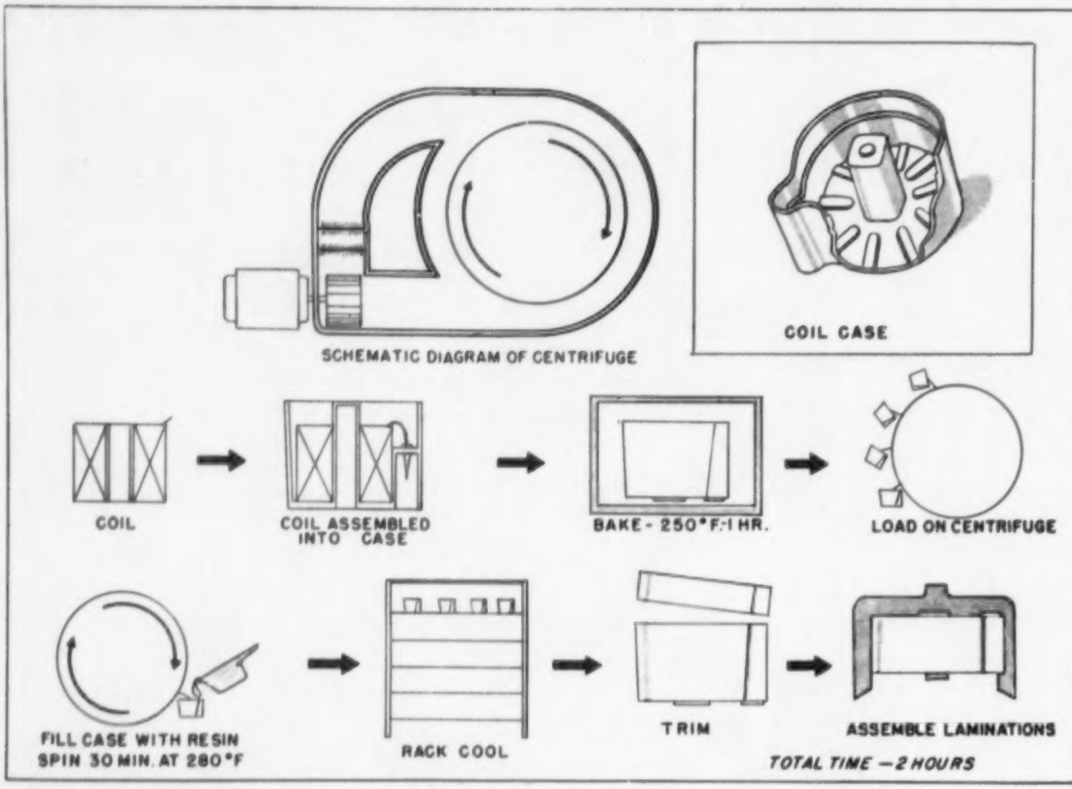



**Fig. 7:** Schematic diagram of successive steps in centrifugal potting

physicals, to increase abrasion resistance, to improve electrical properties, to reduce flow, to increase elongation, to temper the evolution of heat during curing, to improve appearance, to raise thermal conductivity, and to produce a lower coefficient of expansion.

In selecting a filler, a number of items have to be considered. The most important one is the effect such a filler will have on the resin and hardener. Some fillers, such as the bentonites and other clays, are highly alkaline and can contain large amounts of water of crystallization. This will have a tendency to upset the hardener balance during curing and to produce a resin which has poor properties.

Some metallic pigments can act as inhibitors, while others are very active depolymerization catalysts at elevated temperatures and can, therefore, possibly degrade the resin.

Generally speaking, the best fillers are calcined neutral oxides or materials with low chemically combined water. These can improve the arc resistance, dielectric strength, mechanical strength, and dielectric constant. Aluminum oxide and powdered glass are examples of such fillers. To produce thick resins or to make resins which are thixotropic and therefore capable of remaining on vertical walls until cured, a variety of fillers can be used. Perhaps the most effective are asbestos floats or chopped fibrous glass, which impart good surface properties to a coating. Microfine powders such as colloidal silica can also be used in small percentages to control flow.

When delicate or strain-sensitive components such as vacuum tubes or toroids are to be coated or embedded, it sometimes is desirable to have a resin with low stiffness and high elongation so that components with thermal expansion coefficients differing from that of the resin will not be severely stressed over the ambient range. This can be attained by the addition of either plasticizers or flexibilizing copolymers.

Examples of the first-mentioned include polyamines, which also function as hardeners, polyesters such as Thiokol ZL 206, and plasticizers such as tricresyl phosphate.

An example of a flexibilizing copolymer is the Thiokol liquid-rubber series, which, with a suitable hardener or catalyst, can produce epoxy-resin copolymers which have elongations up to 100 percent.

Caution must be exercised, however, since such additions may reduce certain desirable properties of the resin, e.g., solvent resistance, heat stability, and electrical resistivity, among others.

### Separation agents

The epoxide resins have such low shrinkage and good wetting powers that they make excellent adhesives. In some cases this high adhesion is useful but in others it may hinder separation from molds, clean-up of terminals, and clearance of screw holes. The choice of a separating (or part-

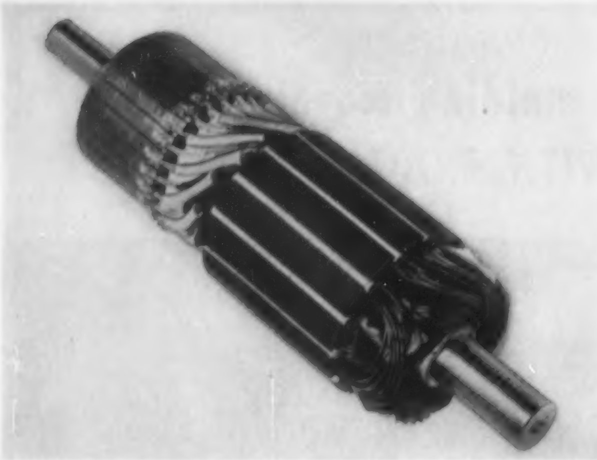


**Fig. 8:** Armature potted with epoxy resin

**Fig. 9:** Plastisol boot used for potting armature in Fig. 8

ing) agent will depend upon the application.

Generally the silicone oils and greases such as Dow Corning 200 fluids, or DC 11 grease, will cause mold surfaces to part cleanly. The criteria for selection of the material are: it should not be an adhesive in itself; it should be insoluble in the resin-mix ingredients; it should not be destroyed at the curing temperatures of the resin.

Ordinary waxes and stearates are not suitable because they will usually melt at the curing temperature and cause inclusions and surface blemishes on the part.

Where high production is involved, a permanent parting agent can be used. The best of these is a thin, sprayed-on Teflon coating. This coating must be sintered at 750° F. to get a fused continuous surface. The finish is excellent and the film is practically indestructible with normal handling. It is insoluble in all solvents and inert to all common chemicals, and no ordinary resin will stick to it. Somewhat lower in cost, and easier to apply, is Pan Glaze, a material made for the baking industry. It is a Dow Corning silicone varnish that is sprayed on the clean mold surfaces and baked. The film formed is not as tough or as slippery as that of Teflon, but it makes a satisfactory parting agent for ordinary purposes.

### Isocyanate resins

Isocyanate is a generic term for a variety of resins that may be polyurethanes, polyamines, or polyureas, or a complex combination of all three. They have in common a diisocyanate cross-linking and copolymerization monomer.

The diisocyanate used is usually selected on the bases of cost and availability. Tolylene diisocyanate, pp′-diphenylmethane diisocyanate, and hexamethylene diisocyanate are the three currently available and useful diisocyanates. Of these only tolylene diisocyanate at $1.35/lb. is within range for most applications. Hexamethylene diisocyanate is about $6.50/lb. and pp′-diphenylmethane diisocyanate costs $3.50/pound.

The diisocyanates can be reacted with a large number of compounds to produce resins ranging from hard to rubbery, from foamy to dense. For polymerization, a polyfunctional material is used that contains active hydrogen atoms in groups such as hydroxyl, amino, carboxyl, etc.

The reaction with a hydroxyl group might be expressed as:

$$\mathrm{OCNRNCO + HOR'OH \rightarrow OCNRNH\overset{\displaystyle O}{\overset{\|}{C}}R'OH},$$

where R stands for the ring, or chain of the diisocyanate and HOR′OH for a diol (such as ethylene glycol) or a dibasic acid. The secondary amine hydrogen can then react further to either continue a chain or to cross link.

From a practical viewpoint, dibasic acids are usually used; they yield long-chain polyesters, the monomers for which are made with a high acid number if a foam is desired. The foam can be either elastomeric or rigid, depending on the spacing and availability of the reactive groups for cross-linking along the linear polymer chain. Castor oil has been used for a semi-elastomeric solid potting resin. Essentially, castor oil consists of the glyceryl esters of 18-carbon fatty acids that have available -OH groups. Upon cross-linking with stoichiometric amounts of a diisocyanate, an excellent potting resin can be obtained for low-frequency use. The rigid foams are used for radar wave guides and radomes, while the solid resins are used for printed-circuit coatings and for potting electronic components that have to stand heavy shock

**Fig. 10:** Potted rotor for all-enclosed 100-hp. motor for acid dust service

at low temperatures. Because the carbamate bond breaks down at high temperatures, thus lowering the electrical resistance of the mass, the isocyanate resins should be regarded as Class A insulating materials, or limited Class B.

The high dielectric constant and polar linkages of the reacted isocyanate result in a rather high loss tangent for high-frequency systems. This may make the use of the solid potting compound undesirable in such cases.

**Silicones**

Inasmuch as no manufacturer of silicone resins has so far bothered to describe chemically his particular commercial resin, it is economically risky for the user to modify such materials for his own specific needs. Instead he must rely entirely upon the manufacturer. This imposes limitations on the use of silicones for some applications.

Silicone structures can be made which are classified as Class H materials. Their properties are unique for some critical high-temperature applications. They are, however, not the perfect electrical insulating material, by any means.

The decomposition temperatures of silicones range near 650° F. and in some special applications it is possible to operate electrical equipment for short periods at that temperature because, after the organic parts have been burned away, a silicon dioxide powder is left. This will still provide some insulation because the sand-like particles keep the electrical elements apart mechanically. The normal operating ranges (in °F.) of the silicones are as follows:

| | *Operation* | *Limited service* |
|---|---|---|
| Rubber | —63 to 350 | 520 |
| Oils | —80 to 450 | 500 |
| Foams | —80 to 500 | 700 |
| Casting resins | —60 to 400 | 480 |

The silicones in current use as coatings and electrical insulation can be said to have the following disadvantages: relatively high cost, long curing times, low hardness, poor water and solvent resistance, high viscosity, poor surface wettability and adhesion, and poor adhesion to other resins.

The following factors are in their favor: they have excellent heat stability and low-temperature resistance to cracking, high thermal conductivity (150% that of normal rubbers), excellent corona resistance, high resistance to arcing, excellent resistance to electrical fatigue, good ozone resistance, and slow combustion rate.

**Polystyrene**

The materials normally used for potting are styrene monomer, partly polymerized styrene, styrene derivatives, high-styrene solutions of polyesters, and filled combinations of these.

The catalysts employed are generally peroxides, and use of accelerators such as mercaptans or amines can decrease gel time.

Styrene-type resins have excellent high frequency dielectric properties, controllable dielectric constant, very low loss tangent, and excellent resistivity.

The main drawbacks to the use of styrene as a potting material are low heat distortion point, poor arc resistance, long cure time, high thermal expansion, poor abrasion and shock resistance, high shrinkage upon curing (15-25% by volume), poor adhesion to surfaces, the difficulty of making strain-free and bubble-free castings, the high vapor pressure of the monomer (it is difficult to use vacuum impregnation), and short storage life.

Foamed-in-place resins are available that are excellent for use in high-frequency equipment where no high ambient temperatures are encountered. Such foams have poor strength and bear only light mechanical loads.

**Glass**

A new material that is essentially a low-melting glass has recently been introduced as a Class H insulation. The material can be regarded as a high-melting thermoplastic with the excellent electrical properties of a high-lead glass. The melting point is about 1100° F. and glasses are available that will match reasonably well the coefficients of expansion of aluminum, copper, or iron.

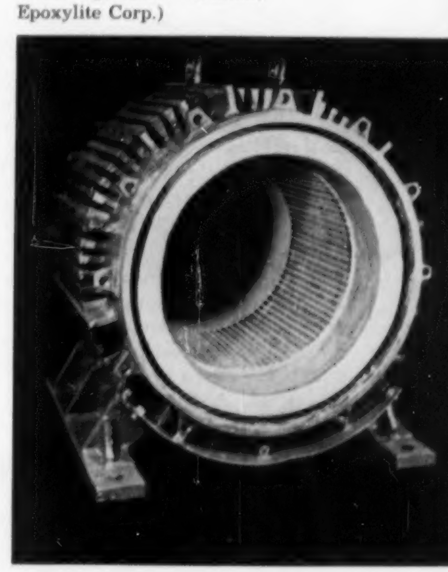
At such temperatures organic insulations are pyrolized, so conductors are used that are insulated with inorganic oxides and similar materials not soluble in the melt.

Coils can be wound with high-conductivity aluminum which has been previously anodized, or with copper that has been plated with aluminum and then anodized before winding.

The expected field of applica-

(*To page* 244)

**Fig. 11:** Encapsulated stator for a large random-wound motor used in a metal grinder. (Photos, Epoxylite Corp.)



# Roll bending

*A new tool for control of gage in vinyl calendering*

*By M. Jukich**

Precise control of the crosswise thickness of calendered film and sheeting is essential for uniform wind-up and subsequent product-manufacturing operations. To offset the bending of the calender rolls caused by the pressure generated in squeezing the stock, the device discussed here, the roll bender, applies a bending moment in the appropriate direction. Because this applied deflection can closely match from point to point the deflection caused by the stock pressure, very accurate correction can be made, with consequent improvement in gage uniformity. The device is easy to add to an existing calender, in contrast to roll-crossing apparatus, and is much less expensive. In a sheet about 0.004 in. thick and 72 in. wide, the mid-sheet thickness may be changed by as much as 0.002 inch.

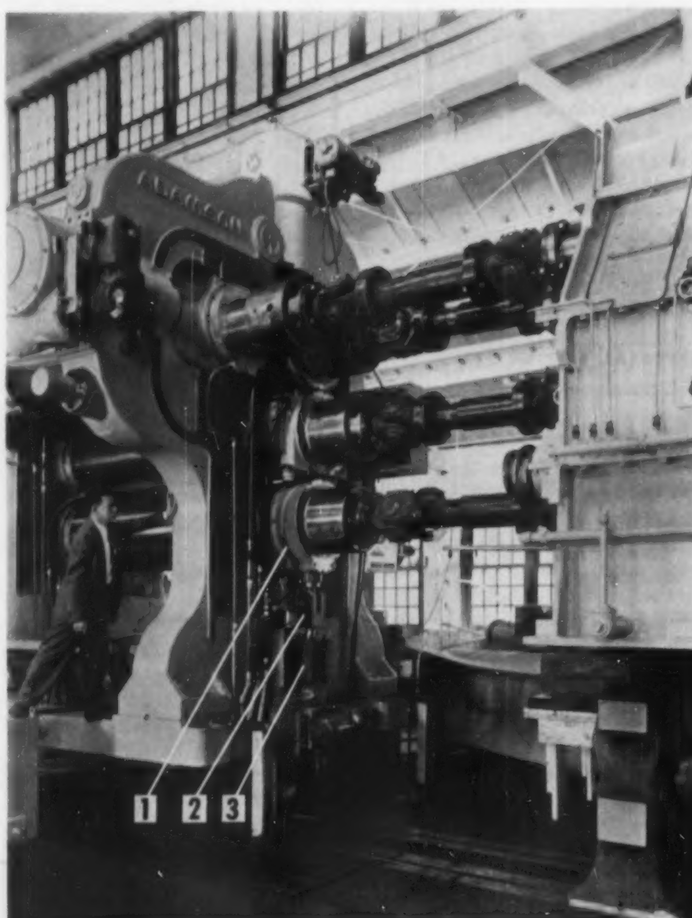
In making calendered vinyl film and sheeting, the resin, plasticizers, coloring materials, and releasing agents are thoroughly mixed under heat and pressure to a dough-like consistency. An intensive mixer of the Banbury type is used. The resulting plastic mass is then worked and mixed further on a two-roll mill which serves as a material bank that feeds the calender.

The material is further worked or mixed in the calender and at the same time it is reduced in gage—or thickness—between succeeding pairs of counter-rotating rolls. The sheet emerges from the final pair of rolls with a finished gage which depends on the actual gap between the rolls. The profile, or variation in thickness from edge to edge, is determined by the shape of the gap as the sheet passes through. And the shape of the gap is dependent on the amount of bending of the rolls resulting from the pressure developed in calendering the stock.

**Evenness of profile**

Why must the sheet profile be uniform? Certainly an accuracy of a few tenths of a mil is not required by the ultimate user of the material. The average housewife probably does not even know the nominal gage of her vinyl tablecloth or shower curtain; she would surely be unaware if this gage should vary throughout the width of material.

But variations in film gage are important to both the maker and the fabricator of calendered sheet. Vinyl film is calendered into rolls several hundred yards long. Any serious variations in profile within a single length is multiplied over and over again by the number of layers in the roll of finished stock. Parts of the rolled sheet are under greater tension




**Calender** with roll bender (and roll crossing). 1—auxiliary bearing for roll bender; 2—clevis; 3—hydraulic cylinder. Counterparts are at other end of roll. (Photo, Adamson United)

*Design manager, Plant Engineering Div., Goodyear Aircraft Corp.

than others and during storage on the roll these parts creep more rapidly. When the sheet is unrolled it no longer lies flat but is baggy and wrinkled, almost impossible to print, cut into patterns, sew, or heat-seal. Aside from the troubles created for the heat sealer by film that is not flat, gage variations cause imperfections in heat seals because of unevenness of heating. The processor doesn't want uneven film.

Historically, a variation of ±5% from nominal gage was allowable. Yet it has long been known that the film would lose its flatness if profile variations of such magnitude were tolerated. And as the uses of vinyl film have broadened, it has been necessary to continuously reduce profile irregularities. In a 5-mil film, 5% is only a quarter of a mil, but the calender rolls may deflect several mils in making such films.

## Deflection of rolls

During calendering the elasticity and viscosity of the stock resist the effort of the rolls to deform it and this resistance is about the same over the whole width of the rolls, which are held in position by heavy bearings at their ends. Each roll may be considered to be simply a supported beam of annular cross-section (the rolls are cored) that is being acted upon by two uniformly distributed loads. One of these is the stock-deformation pressure, the other is its own weight. In the case of rolls mounted one above the other, the pressure and weight act in opposite directions on the middle roll, but act in the same direction on the lower roll. With rolls mounted side-by-side, the weight acts at right angles to the pressure and has negligible influence on the sheet profile. Our attention here is devoted to vertically stacked rolls since they are most commonly used for plastics. For the time being, it is assumed they are perfectly cylindrical in the unstressed state.

According to the theory of elasticity, the deflection, or amount of bending, of such a uniformly loaded, simply supported, cylindrical beam varies from zero at the points of support to a maximum in the center. The equation giving the deflection $y$ as a function of the corresponding distance $x$ from the center is a fourth degree polynomial in $x$, an equation of the form

$$y = a + bx + cx^2 + dx^3 + ex^4.$$

The values of the coefficients $a$, $b$, $c$, $d$, and $e$ are dependent not only on the properties and temperature of the stock but on the roll dimensions and the nominal clearance between the rolls. If all these factors are fixed, however, the coefficients can be calculated and the deflection $y$ can be computed for any distance $x$ from the center.

## Profile control by crown

One way to compensate for this deflection would be to make the roll just $y$ much larger in radius at each distance $x$, so that it is made slightly barrel-shaped instead of cylindrical. This is known as grinding a crown into the roll and the process is expensive. But if only a single stock is to be run at a fixed operating temperature and a fixed roll speed to yield a sheet of fixed thickness and width, an accurately ground crown is probably the best way to compensate for the bending deflection. Of course, both rolls of the gage-fixing pair bend and the equation for the deflection of the upper one is different from that of the lower one because the working loads on them differ by twice the roll weight. Since the deflections are in the same plane, however, the two deflection equations may be added together to give a single equation for the total deflection of the two rolls. It is only necessary to grind sufficient crown on one of the rolls to take care of the total deflection. The other may be cylindrical.

Any particular shape of crown, or course, is developed for a single set of operating conditions. It is highly unlikely that it will be just right for running at any other set of conditions.

Handling a wide range of stocks and operating conditions by fixed crown alone is done in either of two ways. Neither is possible for any but the largest producers. The first is to change rolls when calendering conditions change; this greatly limits the calender output because changing rolls takes time. The second is to have a number of calenders, each for operation over a very narrow range of conditions. Such a very large investment is justified only by large volumes of production in nearly all sheet sizes.

## Manipulation of temperature

The best method of controlling stock temperature consists of longitudinally drilling the rolls and circulating hot water through

(*To page* 145)

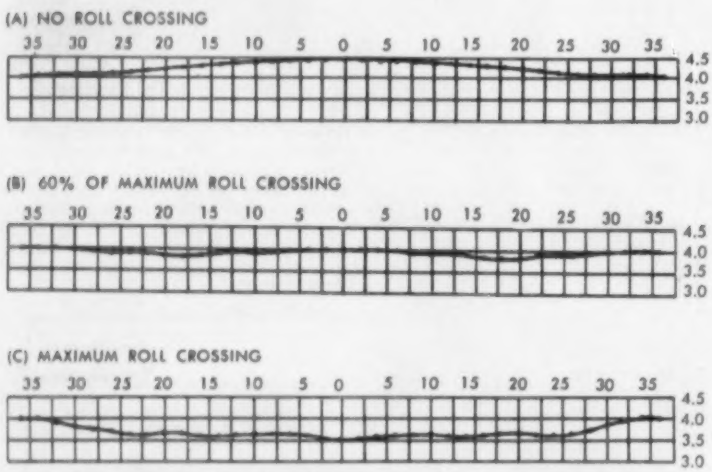



**Fig. 1:** Effect of roll crossing on thickness of vinyl film nominally 4.0 mils thick by 72 in. wide; calender rolls are 32 in. in diameter, 92 in. wide. Numbers at top are distances from center of sheet in inches; at right are measured thicknesses in mils

Pump parts on this beverage jug are molded from BAKELITE Brand C-11 Plastic. Details are on next page.

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Speed and success in finding the plastic you need will often depend on the variety of materials available. Bakelite Company offers a direct route to the largest number of plastics in widest use today. As a further aid, you can call on the guidance of qualified technical experts backed by extensive research and development facilities. Plants and warehouses are strategically located across the country to provide prompt delivery and service. Some of the outstanding end-products that result are described on the following pages.

*(continued on next page)*

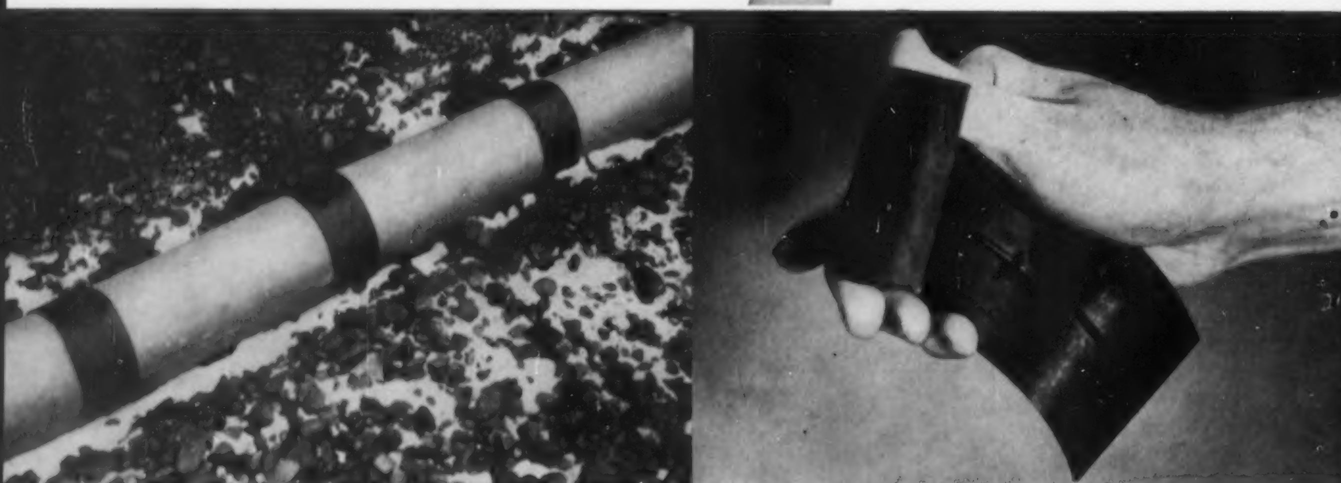
(continued from preceding page)

## C-11 parts are colorful, tough, resistant to staining

The pump unit on the insulated jug, except for the bulb, is made of Bakelite Brand C-11 Plastic. The unit consists of red spout, beige threaded ring, and black pump body. These sections are bonded together to form an integral unit. The resistance of C-11 to citrus oils, alcohol, hot tea, and coffee is one reason for its use. Another factor is the toughness of C-11; the pump unit is handled frequently, and must be removed when the jug is filled or washed. The tube is a flexible extrusion of Bakelite Brand Polyethylene.

Bakelite C-11 Plastic is an acrylonitrile-styrene copolymer with excellent mechanical strength and chemical resistance. Wide color possibilities and a high degree of clarity make it useful for a variety of eye-catching products.

"Skotch O'Matic" jug pump parts molded by **Campro Company,** Canton, Ohio, for **Hamilton Metal Products Co.,** Hamilton, Ohio.



"Boco" tile clips molded by **Mayfair Plastics, Inc.,** Detroit 2, Mich., for **Boco Industries, Inc.,** Detroit 19, Mich.

## Polyethylene's durability meets the field tile test

This joint-covering device molded of Bakelite Brand Polyethylene keeps stones and soil from working between field tile sections and clogging sewage disposal systems. These tile clips are strong, tough, and resistant to disintegration by moisture, acids, and alkalies in the ground. In addition, they aid in spacing the tiles. Each clip has lugs integrally molded on its underside to assure the exact ⅜-in. separation needed to permit tile expansion while preventing entry of soil and stones. A fin molded into the top serves as a handle and guide to proper alignment. The clip covers only the top and sides of the joint, leaving the bottom open for dispersal of liquids.

This is an example of the toughness and chemical resistance of Bakelite Polyethylene. Some of the more decorative applications of this material, such as kitchenware and squeeze bottles, make use of its color range and fine molding details.

Automotive door handle escutcheons molded by **The Jim Robbins Co.**, Detroit, Mich., for **Automotive Appliance Co.**, Detroit, Mich.

## Flexible vinyl fittings speed assembly of door hardware

Flexible escutcheons make practical, decorative fittings for inside door handles and window cranks on automobiles and trucks. These examples are injection molded from BAKELITE Brand Elastomeric Vinyl Plastic VND-9960. Notice their extremely high gloss. They come in any color desired, including striking metallic effects.

Installing these flexible parts is a fast operation. No springs are needed to hold them in position. There's no breakage. Metal ferrules are simply snapped into place, often at the rate of 1500 units per hour.

BAKELITE Elastomeric Vinyl Plastics are available in several formulations to cover a wide range of applications. Their flexibility can be varied from semi-rigid to soft. Finishes can be glossy or matte. Transparent, translucent, or opaque effects can be achieved in a wide range of colors.


Handle for Westinghouse "Steam-N-Dry" Iron molded by **Bryant Electric Co.**, Hemco Plastics Div., Bridgeport 2, Conn.; dials molded by **Bridgeport Moulded Products, Inc.**, Bridgeport 5, Conn.

## Phenolic plastic makes a cool, comfortable, handsome handle

The cool, comfortable handle for the new Westinghouse "Steam-N-Dry" Iron is molded of BAKELITE Brand Phenolic Plastic BM-14316. The open-front design has a practical advantage—it simplifies ironing in deep pockets, pleats, seams, and sleeves. Its shape reduces hand fatigue. The rich black color and smooth, gleaming surface enhance its appearance. Eye-appeal and heat resistance were also factors in selecting this BAKELITE Phenolic Plastic for the fill-dial and fabric-setting dial.

BM-14316 Black is a two-step, general-purpose wood-flour-filled material characterized by long flow and ease of release. Among its many applications are deep-draught moldings such as cabinets and cases. Because of its wide molding latitude, it can be fabricated in slower-operating equipment without loss of plasticity.

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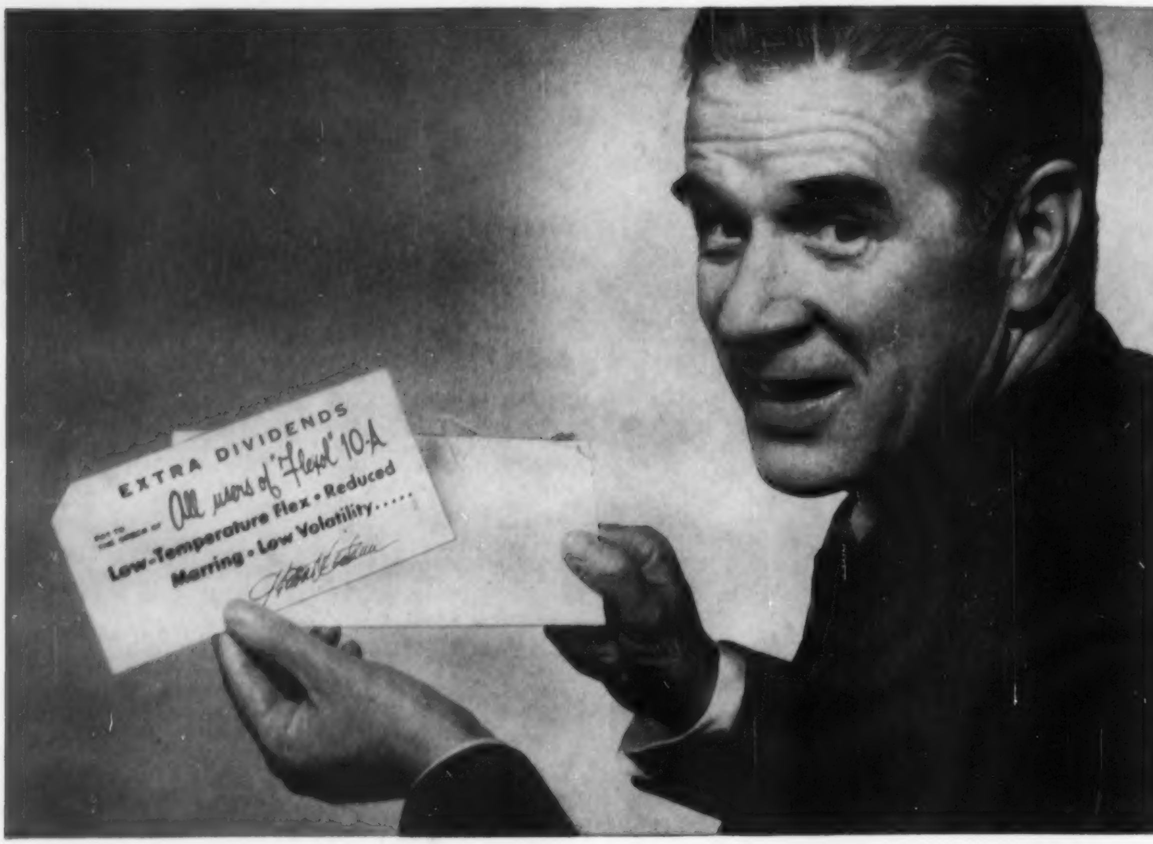


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them under high pressure. This provides uniform temperature across nearly the whole face of each roll. Heat loss from the end surfaces results in some drop in temperature for a few inches in from both ends, but this part of the sheet is usually trimmed. This uniformity of temperature eliminates variations in sheet profile due to local changes in temperature. The hot-water system also permits quick raising or lowering of the stock temperature. Since changes of temperature result in changes in the plasticity of the stock, manipulation of temperature permits some profile regulation. However, experience has shown that actually only minor temperature changes are really possible, usually less than 8° F. Too low a temperature results in cold checks, while too high a temperature leads to processors' problems such as poor stripping. Temperature manipulation over this narrow range is of little use in profile control.

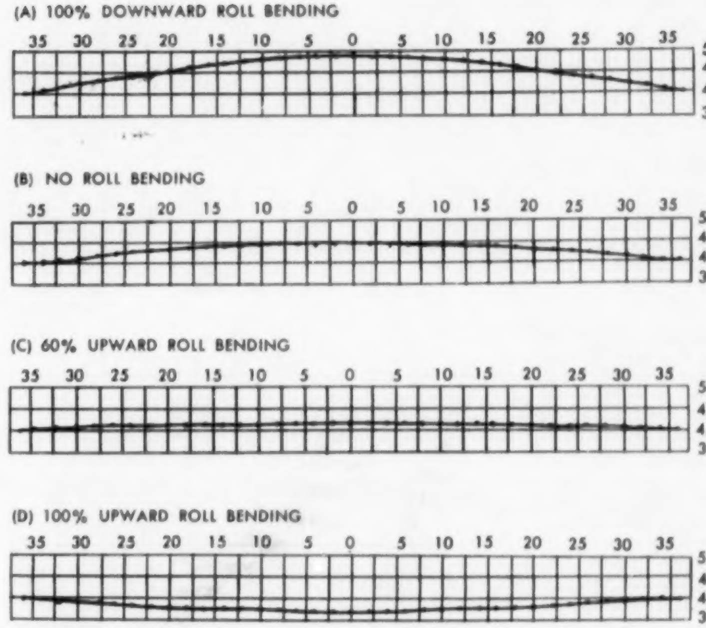



**Fig. 2:** Effects of bending bottom roll of 32- by 92-in. calender. Film is nominally 4.0 mils thick by 72 in. wide

## Roll crossing

Consider two perfectly cylindrical rolls mounted parallel, one above the other, and at rest. Their axes are in the same plane and the aperture between them is a long rectangular slot. Their midpoints establish a vertical line. Now let one of these rolls be rotated lengthwise around this vertical line. As it rotates, the center points keep their positions, since they are on the line of rotation. But the ends move apart. Thus the gap between the rolls widens at the ends but remains unchanged at the center. This process of deliberate misalignment of the rolls is called roll crossing. If the moving roll is rotated slightly through a small part of a degree, the aperture becomes double-trapezoidal as shown in the very exaggerated sketch below.

Now we have a pair of rolls which are closer together at the center than at the ends. If the angle of crossing is suitably chosen, the center deflection of the rolls should be exactly offset and the sheet should have the same thickness at center and edges. With a slightly different angle of crossing the same result may be achieved with crowned rolls that are producing sheet too thick in the center. Fig. 1, p. 140, shows the effects of different degrees of roll crossing on the profile of vinyl film.

In discussing the nature of the deflection it was pointed out that an uncorrected profile would have a shape given by a fourth-degree polynomial. The roll-crossing method, on the other hand, applies a linear correction; that is, the gap increases at a constant rate from center to edges. This would be represented by an equation of the first degree

$$y = a + bx.$$

Clearly this can make only a crude approximation to the more complex form of the true deflection curve. The resulting profile, though matched at center and edges, has the "oxbow" form of Fig. 1B. This profile shows a maximum variation of about 0.2 mil, or 5% below nominal. This deficiency is not a serious problem in the production of heavy films and sheeting, but it does, in our opinion, become serious when calendering light-gage films since it becomes more pronounced as gage is decreased. In other words, roll crossing produces the least satisfactory profile correction on light-gage films where, unfortunately, only the smallest amount of profile irregularity can be tolerated.

Another but less serious deficiency of roll crossing is the impossibility of using it to correct for too much crown, i.e., to make the sheet thicker at the center, thinner toward the edges. The reason for this is that no matter which way the roll is shifted to cross the rolls, it is impossible, even with cylindrical rolls, to produce a gap of the shape that is sketched here. Thus,

since the gap can only be widened at the edges and not at the center, it is necessary to accurately determine minimum crown requirements. If too much crown is used and if conditions should change so that less crown is needed, the rolls may have to be changed. On the other hand, starting out with too low a crown results in a re-

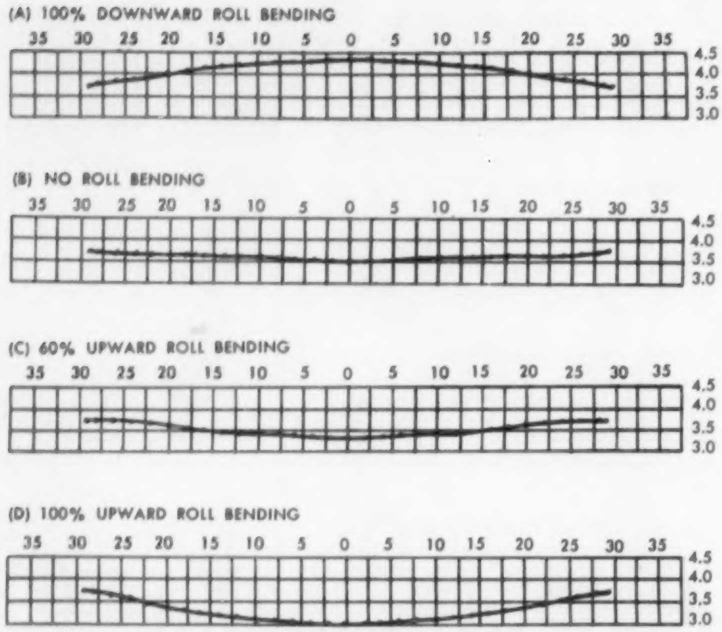



**Fig. 3:** Effects of bending bottom roll of 24- by 68-in calender. Nominal thickness of film is 3.75 mils, its width is 58 inches

duced range of possible thickness correction.

Finally, roll crossing is expensive to build into a new calender and even more expensive to install in a producing calender, since production is lost while the change is made. Because the roll axes are no longer parallel and fixed, they must be driven through universal-jointed drive shafts. The inclusion of roll-crossing equipment in a new calender increases the machinery cost by about half.

### Beta-ray gage

A beta-ray gage can be an invaluable aid in profile control. Though the gage exerts no controlling influences on the sheet, it provides a fast indication of changes in stock profile and permits rapid, stock-saving adjustments. This is especially true of installations using double traversing pickups to get readings across the full width of the sheet being calendered.

### Desired control still lacking

Careful consideration of all these methods of profile adjustment have led to a number of conclusions.

First, all were helpful. Second, they were not entirely adequate whether used singly or in combination. Third, they all lack the basic ability to *control the roll deflection*, and merely attempt to compensate for it. It was therefore concluded that an external, controllable means of bending the rolls was needed and a study was undertaken to calculate the forces needed to accomplish the desired amount of bending. The problem was then discussed with Adamson United, one of the recognized authorities in calender design. The idea was a rather radical one and several serious problems arose. But ways and means were worked out and, after due incubation, the newly conceived roll bender was born. A new calender equipped with roll crossing, circulating - hot - water temperature control, beta-ray gages, and a roll bender was ordered, built, and placed in operation within a year.

### Roll bender in operation

In its present form, the roll bender applies a bending moment to the ends of a calender roll. While this is not exactly equivalent to applying a uniformly distributed load, it is a very close approximation for deflections of the size important in calendering. A simply supported beam so bent has a deflection curve of the third degree, that is, a curve having the form

$$y = a + bx + cx^2 + dx^3$$

Such a curve can be made to reproduce very closely from point to point the fourth-degree deflection curve of the rolls under the processing pressure. Theoretically, then, the roll bender offered high hopes of accurate gage control. And these hopes were verified immediately in trial. The device has the added advantage that it can be adjusted in both directions, so that the thickness of the sheet at the center can be either diminished or increased, as desired.

Fig. 2, p. 145, shows typical profiles of sheet obtained with varying degrees of roll bending. Note the smoothness of these profiles—their comparative freedom from irregular bumps and dips and reversals of curvature. Note also that the total displacement of the profile midpoint between 100% upward roll bending and 100% downward roll bending is nearly 1.5 mils on a gage of 4 mils, a very wide range of control. These particular experiments were not aimed at making a perfectly flat film—their purpose was to demonstrate the degree and quality of control obtainable with roll bending. Interpolation between Figs. 2C and 2D, p. 145, however, indicates that a very nearly flat film would have been obtained with approximately 75% upward roll bending.

### Bigger and better benders

Although the initial performance tests were highly successful, there was still the possibility of excessive bearing wear or roll fatigue. Months later when the rolls were removed for a regrind job it was plain that only normal wear had occurred. It was then decided to install the roll-bending unit on one of our existing calenders. The new unit was to provide even greater bending moments. A short time later and after a shut-down of less than a week, the unit was ready for trial;


BACH



sample results on 58-in. film are shown in Fig. 3, p. 146. As was expected, the range of control here is even greater: about the same maximum difference in deflection was obtained with rolls only 75% as wide.

Recently a roll bender was installed on the top roll of one of our calenders that already had one on the bottom roll. This was expected not only to facilitate the production of flatter sheet, but also to increase the range of gages and formulations that can be run on a single calender. Some typical results of this change are shown in Fig. 4, below, and they reveal a still wider control range (almost 50% of nominal gage). The diagrams above the profiles show the directions of thrust of the roll benders to produce the desired deflection.

**How the roll bender works**

The diagrams in Fig. 4, below, show the principle of operation of the roll bender, and the actual equipment is almost as simple as the principle. At each end of a roll having a roll bender there are two sleeve- or roller-type bearings: the spherically seated main bearing that is anchored to the frame and that maintains the position of the roll, and the movable roll-bender bearing, to which the crown-controlling forces are applied. Each of the outer bearings is linked by a clevis and shaft to the piston of a hydraulic cylinder. A high-pressure pump, on demand, forces oil into either the upper or lower ends of the cylinders, depending on which way it is desired to bend the rolls. As oil is forced into the lower ends, for example, the tips of the roll are forced upward and its center is bent downward.

An installation is shown in the photograph on p. 138. The roll-bending equipment is surprisingly compact, though it develops tremendous forces on each end of the roll. The particular calender shown, of the inverted-L type, happens to be fitted with roll-crossing equipment, too. Universal joints and splined connectors link the rolls with the huge gear box on the right and provide the angular adjustability needed for driving the misaligned rolls.

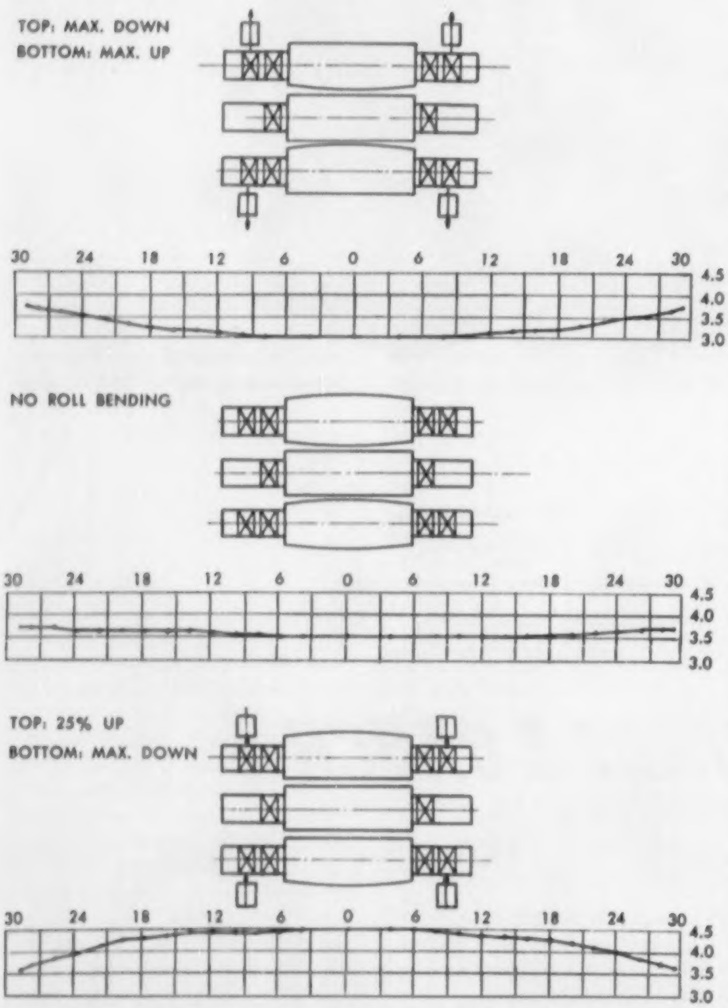



**Fig. 4:** Roll bending of both top and bottom rolls on 24- by 68-in. calender. Sheet is nominally 58 in. wide by 3.75 mils thick

**Conclusion**

Roll-bending equipment raises the cost of a calender about 15 to 20%, as compared with about 50% for roll-crossing equipment. It requires much less space, gives more accurate and more versatile control of profile, and takes much less time to install on existing calenders. Five calenders with roll benders are now operating.

Although the roll bender has so far been used only with crowned rolls, it offers attractive possibilities for use with straight cylindrical rolls, since they are cheaper to make and maintain. Because the rolls are always bent apart by the processing pressures, doing away with crown would sacrifice some of the now-available range of processing conditions. On the other hand, any single crown curvature can be correct at only a very few sets of conditions, as has been shown. At other conditions, the roll bender with straight cylindrical rolls may be able to make nearly as accurate a compensation for the processing load as would crown and bender together. Finally, it may be possible to apply still bigger bending moments and so get even wider compensation than has yet been achieved.

Roll bending seems to be the most useful method invented for controlling gage of calendered film and sheeting; certainly its limits have not yet been reached.

# A simple, reliable impact test

*Impact resistance can be measured under purely tensile loads, thus rationalizing design of parts for shock loading*

For years the designer of load-bearing parts has had almost no fundamental data on which to base a choice of materials for impact service. Now an inexpensive, simple, unambiguous tensile-impact test opens a new era of reliability in the design of parts for impact service. The test uses standard Izod equipment modified to hold a variety of specimens in such a way that they are tested in pure tension rather than bending. Both stiff and limp materials may be tested by the new method.

### Notched-Izod is traditional

The notched-Izod test, very popular because the required apparatus is relatively inexpensive, has long enjoyed a certain degree of acceptance in the testing of metals. However, the design of metal parts is usually based on keeping the metal within its elastic limit; a slight degree of plastic flow is often fatal. Thus elastic modulus and yield strength, on the basis of weight of material used, are far more important design criteria for metals than notched-Izod (or other) impact measurements.

As plastics came into use, they were not used for structural parts of bridges, buildings, and heavy machinery because they had insufficient rigidity per unit cost. They did, however, find wide acceptance in housewares, toys, machine parts, electrical apparatus, and packaging. In these uses they were often subject to severe and sudden mechanical loads, and soon the notched-Izod test, the "Available Jones" of the impact-testing arsenal, was in wide use as almost the only official measure of impact strength for plastics. Another measure is the area under the stress-strain curve in the standard tensile test. But plastics are very sensitive to the time rate at which the load is applied, and the standard tensile test is run at a rate of loading thousands of times lower than is encountered in normal service impacts. The Izod test offered the advantage of applying the load at a reasonably high rate.

### Izod not reliable

It was soon realized that any but the crudest correspondence between the results of this test and the actual performance in the field of plastic materials under impact loads was purely coincidental. But, it was reasoned, any high-rate test is better than none. And so notched Izod has continued in wide use as a basis of design even though it estimates an ill-defined and changeable combination of material properties. Mostly it appears to measure the notchsensitivity of materials under the influence of a high-rate, three-dimensional system of assorted stresses. And for the more flexible materials, like polyethylene, the test is meaningless since these materials, instead of being broken, merely twist aside and escape the brunt of the impact blow.

### Basis of new test

Most impact failures begin because somewhere in the specimen there is a too-high tensile stress. Thus, if possible, we should attempt to measure the ability of plastics to withstand sudden tensile loads. This kind of measurement would have the additional advantage that, since more is known about the analysis of tensile stresses than any other kind, the results would be more widely applicable to objects of various shapes. Apparatus to do this has been built but it is expensive and complicated. Test pieces must be carefully prepared in a particular shape, and testing is relatively slow.

### Measures impact in tension

The new tensile-impact test changes all this. At the Cleveland S.P.E. meeting, Dr. Chester Bragaw of the Du Pont Polychemicals Dept. showed how anyone can alter Izod equipment to make impact measurements in pure tension. The new method also permits the tester to measure notchsensitivity directly. A wide variety of shapes may be tested and specimens can be molded, cut from sheets, machined from rods, or cut out of commercial products. Materials need not be stiff. In thin-film form they may be tested by cutting a number of strips from the film and stacking them together for the impact blow. The gage-length and cross-sectional area under stress of the test specimen are accurately known, and the stress has the same value over the entire cross section being stressed.

### Should see widespread use

To this writer, the new test seems to open the way to a revolution in impact-testing. Results so far available indicate that tensile-impact measurements show a high correspondence with failure of various plastics in several types of impact service. No development of the last twenty years in materials testing can approach this one in improving the reliability of plastics performance. Let us hope that the plastics industry and the ASTM give it speedy acceptance.—*J.F.C.*

Plastics* Technical Section

Dr. Gordon M. Kline, Technical Editor

# Prestressed reinforced plastics

By S. Goldfein†

This investigation was made to determine whether the flexural properties of polyester-glass fiber laminates can be improved through prestressing. It was found that, in the direction of prestress, the flexural strength increased in proportion to the extent of the prestress, with increases up to 50% recorded; the flexural breaking strengths increased up to 68%; data on flexural modulus were too scattered to indicate definite trends; average stiffness increased up to 47%; tensile and shear strengths were not significantly affected; compressive strengths, both flat and edgewise, decreased from 2 to 14%; impact strengths increased up to 8 percent. In the direction perpendicular to the prestress, all of the properties with the exception of impact strength were decreased by prestressing the laminate. These decreases varied from 2 to 33%; the impact strength increased up to 12 percent. Prestressing appeared to have a greater effect on laminates with high percentages of glass than on those with low percentages of glass. After aging for periods of 7 to 19 months the laminates lost as much as one-third of their gains due to prestressing. Prestressing appeared to increase the wet strength retention by 30% in the case of the 114 finish and up to 28% in the silane finishes.

The Corps of Engineers is currently investigating the possibilities of developing a number of items using materials fabricated from polyester resins reinforced with glass fibers. These materials are well known for their high strength, light weight, and corrosion resistance. Because of the similarity between the structures of reinforced concrete and reinforced plastics, the possibility of prestressing reinforced plastics in a manner similar to one of those which are presently used to pretress reinforced concrete was investigated.

The process of prestressing as practiced in the reinforced concrete field has been known for many years. It comprises the application of a compressive force axially to a beam, resulting in a product with greater flexural strength.

One of the techniques employed to prestress concrete involves stressing high-strength steel wires in tension, pouring concrete around the steel wires, allowing the concrete to set hard, and then releasing the tension on the wires when the concrete is strong enough to withstand the resultant axial compression. Concrete is weak in tension. Consequently, the steel wire reinforcement is usually placed in the bottom of the beam where tensile forces are developed when the beam is flexed.

### Fabrication of laminates

The fabrication procedure consisted of impregnating the glass fibers with polyester resin in a mold, stressing the outer layers of fibers in tension, applying pressure perpendicular to the plane of the laminate in a press, heating the assembly until the resin was completely cross-linked, cooling the laminate to room temperature, releasing the tension on the prestressing elements, and removing the prestressed plastic from the mold.

At the same time, unstressed laminates were fabricated to serve as basis for comparison. Portions of the laminates were cut into

*Reg. U.S. Pat. Off.
†Chief, Plastics Unit, Engineer Research and Development Laboratories, Fort Belvoir, Va. Mr. Kurt Schneider, now with Sikorsky Aircraft, Edwin Heck, and Cleveland Rollins of the Materials Branch, Rubber and Plastics Section, conducted the laboratory work.

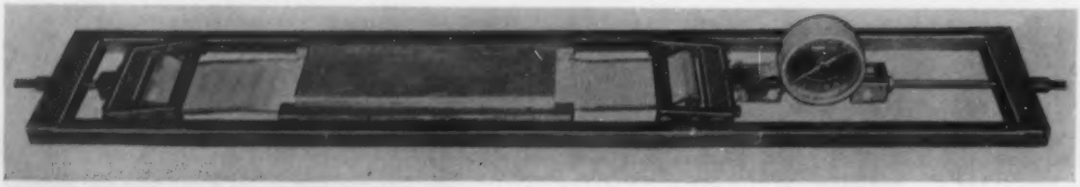


**Fig. 1:** Laboratory apparatus, showing prestressed laminate in place after fabrication

specimens for immediate evaluation while others were tested after aging.

*Apparatus.* The equipment consisted of a frame made with side bars of hot-rolled steel $1\frac{3}{16}$ by $1\frac{3}{16}$ by 64 in., and end blocks of cold-rolled steel $11\frac{1}{4}$ by $2\frac{1}{4}$ by $1\frac{3}{8}$ inches (Fig. 1). The end blocks had $\frac{9}{16}$-in. holes in their centers to hold the fastening assembly ends. A tensile stress was applied to the glass by tightening the nuts on the ends of the fastening assembly. An aluminum mold, 20 in. in length, in which laminates with a 6-in. width could be fabricated, was fastened to the side bars by two screws in each side. The bottom of the aluminum mold was approximately $\frac{1}{2}$ in. thick and the top cover was $1\frac{1}{4}$ in. thick. A similar aluminum mold was used to fabricate unstressed laminates. A 15,000-lb. capacity Dillon dynamometer was employed to determine the applied load. Steel spacers 17 by $\frac{1}{8}$ in. by the desired thickness were used to regulate the thickness and thus the concentration of glass fibers in the laminates. The laminates were fabricated in a hydraulic press with steam-heated platens.

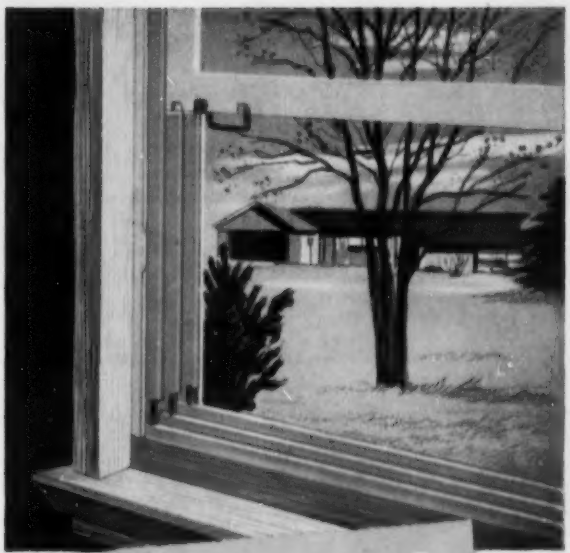
*Materials.* The materials used in fabricating the laminates evaluated here are listed in Table I.

*Prestressing and molding operation.* The mold was cleaned before each lamination so that a smooth surface resulted. The bottom mold and adjacent steel side bars were coated twice with Hy-Glo by brush, and the top cover plate was coated with a thin film of DC-7 grease. The desired number of strips of the material to be stressed, approximately $5\frac{1}{2}$ by 60 in., were placed in the position indicated in Fig. 1. The material passed around the inner steel roller and was held loosely in place by the outer roller of the assembly. A slight force was applied to the material by tightening the assembly ends to orient the fibers. A visual check was made to insure proper alignment. A polyester resin, such as Marco 28-V, which had been cured to harden at room temperature in approximately 30 min., was then applied to the material around the rollers, and for a length of 6 in. beyond the outer rollers. Wooden boards, covered with cellophane, were placed under and over the impregnated areas. Weights were placed on the top board while the cross-linking of the resin took place. During this period a slight force was again applied to tighten the material around the inner rollers.

After the resin hardened, the boards were removed and the assembly ends were loosened to facilitate the placing of layers of reinforcing material between the prestressing elements in the mold. The fibers were maintained as parallel as possible throughout. The assembly ends were tightened and, while the material was taut, two finely drawn parallel lines, 12 in. apart, were marked off on the glass fibers with a pencil so that the elongation, before and after lamination, could be measured. Steel spacers were then placed in position on both sides of the lay-up. The lay-up was impregnated with resin catalyzed with 4% ATC, covered with

**Table I:** Materials used in investigation

| *Material* | *Source* |
|---|---|
| Glass cloths | |
| No. 184, 114 finish | Owens-Corning Fiberglas Corp. |
| No. 181, 114 finish | Owens-Corning Fiberglas Corp. |
| No. 181, 136 finish | Owens-Corning Fiberglas Corp. |
| No. 181, Volan A finish | Owens-Corning Fiberglas Corp. |
| No. 128, 114 finish | Owens-Corning Fiberglas Corp. |
| No. 143, 114 finish | Owens-Corning Fiberglas Corp. |
| No. 181, Garan finish | Libbey-Owens-Ford Glass Fibers Co. |
| No. 1000, 114 finish | United Merchants Industrial Fabrics Div., Davis Mills Corp. |
| No. 181, NOL-24 finish | Naval Ordnance Laboratory |
| Glass fibers | |
| Random mat, M503, polyester bonded | Owens-Corning Fiberglas Corp. |
| Parallel-strand mat, polyester bonded | Owens-Corning Fiberglas Corp. |
| Parallel-strand mat, 660B, polyester bonded | Facile Corp. |
| Resins | |
| Paraplex P-43 | Rohm & Haas Co. |
| Laminac 4115 | American Cyanamid Co. |
| Marco 28V | Marco Chem. (Celanese) |
| Epon 828 | Shell Chemical Co. |
| Catalysts | |
| Benzoyl peroxide (Luperco ATC) | Novadel-Agene Corp. |
| Methyl ethyl ketone peroxide (DDM) | Novadel-Agene Corp. |
| Mold release agents | |
| Hy-Glo | Western States Lacquer Corp. |
| DC-7 | Dow Corning Corp. |







cellophane, and the air bubbles removed by rolling gently. The desired force was applied and noted by reading the dynamometer. The elongation was also recorded by measuring the distance between the two penciled lines on the glass. The cover plate was put in position and the mold placed in the hydraulic press. The laminates were cured at approximately 50 p.s.i. and 250° F. for 30 minutes. After cooling under pressure, the prestress load was again recorded and the tension released while the laminate was still in the hydraulic press under pressure. Another reading of the elongation was taken after the laminate was removed from the mold.

*Exploratory experiments.* A number of laminates were fabricated using M503 random mat as the reinforcement material and parallel-strand mat as the prestressing elements. The first experiments were concerned with locating the optimum position for the prestressing elements. The general usage in the reinforced and prestressed concrete field is to place the prestressing elements on the bottom and as far away from the neutral axis as possible. This plan was followed for the

**Table II:** Laminate lay-ups[a]

| Laminate No. | Resin | Top reinforcement: No. of layers | Top reinforcement: Unstressed | Top reinforcement: Stressed | Center reinforcement: No. of layers | Center reinforcement: Unstressed | Bottom reinforcement: No. of layers | Bottom reinforcement: Unstressed | Bottom reinforcement: Stressed |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Marco 28V | - | - | - | 5 | M503 mat[d] | 1 | PSM[b] | |
| 2 | Marco 28V | - | - | - | 5 | M503 mat[d] | 1 | | PSM[b] |
| 3 | Laminac 4115 | 1 | PSM[b] | | 5 | M503 mat[d] | 1 | PSM[b] | |
| 4 | Laminac 4115 | 1 | | PSM[b] | 5 | M503 mat[d] | 1 | | PSM[b] |
| 5 | Laminac 4115 | 2 | PSM[b] | | 5 | M503 mat[d] | 1 | PSM[b] | |
| 6 | Laminac 4115 | 2 | | PSM[b] | 5 | M503 mat[d] | 2 | | PSM[b] |
| 7 | Paraplex P-43 | 2 | PSM[c] | | 4 | 184-114 | 2 | PSM[c] | |
| 8 | Paraplex P-43 | 2 | | PSM[c] | 4 | 184-114 | 2 | | PSM[c] |
| 9 | Laminac 4115 | - | - | - | 14 | 1000-114 | | | |
| 10 | Laminac 4115 | 1 | | 1000-114 | 12 | 1000-114 | 1 | | 1000-114 |
| 11 | Laminac 4115 | 2 | | 1000-114 | 10 | 1000-114 | 2 | | 1000-114 |
| 12 | Laminac 4115 | - | - | - | 21 | 128-114 | - | - | - |
| 13 | Laminac 4115 | 1 | | 128-114 | 19 | 128-114 | 1 | | 128-114 |
| 14 | Laminac 4115 | 2 | | 128-114 | 17 | 128-114 | 2 | | 128-114 |
| 15 | Laminac 4115 | 3 | | 128-114 | 15 | 128-114 | 3 | | 128-114 |
| 16 | Laminac 4115 | 4 | | 128-114 | 13 | 128-114 | 4 | | 128-114 |
| 17 | Paraplex P-43 | - | - | - | 6 | 184-114 | - | - | - |
| 18 | Paraplex P-43 | 1 | - | 184-114 | 4 | 184-114 | 1 | 184-114 | |
| 19 | Paraplex P-43 (conc. varied) | - | - | - | 6 | 184-114 | - | - | - |
| 20 | Paraplex P-43 (conc. varied) | 1 | | 184-114 | 4 | 184-114 | 1 | | 184-114 |
| 21 | Paraplex P-43 (conc. varied) | - | - | - | 6 | 184-114 | - | - | - |
| 22 | Paraplex P-43 (conc. varied) | 1 | - | 184-114 | 4 | 184-114 | 1 | - | 184-114 |
| 23 | Paraplex P-43 | - | - | - | 15 | 143-114 | - | - | - |
| 24 | Paraplex P-43 | 3 | | 143-114 | 9 | 143-114 | 3 | - | 143-114 |
| 25 | Laminac 4115 | - | - | - | 15 | 143-114 | - | - | - |
| 26 | Laminac 4115 | 3 | - | 143-114 | 9 | 143-114 | 3 | - | 143-114 |
| 27 | Laminac 4115 | 1 | 143-114 | - | 5 | M503 | 1 | 143-114 | |
| 28 | Laminac 4115 | 1 | - | 143-114 | 5 | M503 | 1 | - | 143-114 |
| 29 | Paraplex P-43 | - | - | - | 15 | 181-114 | - | - | - |
| 30 | Paraplex P-43 | 3 | - | 181-114 | 9 | 181-114 | 3 | - | 181-114 |
| 31 | Paraplex P-43 | - | - | - | 15 | 181-136 | - | - | - |
| 32 | Paraplex P-43 | 3 | - | 181-136 | 9 | 181-136 | 3 | - | 181-136 |
| 33 | Paraplex P-43 | - | - | - | 15 | 181-Garan | - | - | - |
| 34 | Paraplex P-43 | 3 | - | 181-Garan | 9 | 181-Garan | 3 | - | 181-Garan |
| 35 | Paraplex P-43 | - | - | - | 15 | 181-Volan A | - | - | - |
| 36 | Paraplex P-43 | 3 | - | 181-Volan A | 9 | 181-Volan A | 3 | - | 181-Volan A |
| 37 | Paraplex P-43 | - | - | - | 15 | 181-NOL-24 | - | - | - |
| 38 | Paraplex P-43 | 3 | - | 181-NOL-24 | 9 | 181-NOL-24 | 3 | - | 181-NOL-24 |
| 39 | Epon 828-CL | - | - | - | 15 | 181-NOL-24 | - | - | - |
| 40 | Epon 828-CL | 3 | - | 181-NOL-24 | 9 | 181-NOL-24 | 3 | - | 181-NOL-24 |

[a]Cloth unless otherwise indicated
[b]Parallel-strand mat produced by Owens-Corning Fiberglas Corp.
[c]Parallel-strand mat produced by Facile Corp.
[d]Random chopped fiber mat produced by Owens-Corning Fiberglas Corp.

**Table III:** Effect of prestressing on wet strength of cloth-type 181 laminates

| *Property* | Laminate No. 29 | 30 | 31 | 32 | 33 | 34 |
|---|---|---|---|---|---|---|
| Finish | 114 | 114 | 136 | 136 | Garan | Garan |
| Condition | Unstressed | Prestressed | Unstressed | Prestressed | Unstressed | Prestressed |
| Flexural strength | | | | | | |
| Initial, p.s.i. | 60,600 | 70,500 | 63,400 | 61,700 | 63,500 | 54,900 |
| After 30 days immersion in tap water, p.s.i. | 35,950 | 63,000 | 57,300 | 59,800 | 62,800 | 61,300 |
| Retention of initial dry strength, % | 59.3 | 89.5 | 90.4 | 96.7 | 98.8 | 112 |
| Modulus of elasticity in flexure | | | | | | |
| Initial | | | | | | |
| 0-50%[a] ultimate breaking strength, $10^6$ p.s.i. | 3.21 | 3.45 | 3.42 | 3.47 | 3.51 | 3.28 |
| 50-100%[b] ultimate breaking strength, $10^6$ p.s.i. | 2.56 | 2.91 | 2.79 | 2.69 | 2.75 | 2.76 |
| After 30 days immersion in tap water | | | | | | |
| 0-50% ultimate breaking strength, $10^6$ p.s.i. | 3.01 | 3.98 | 3.19 | 3.34 | 3.79 | 4.10 |
| 50-100% ultimate breaking strength, $10^6$ p.s.i. | 1.81 | 2.97 | 2.42 | 2.30 | 2.90 | 3.30 |
| Retention of initial modulus | | | | | | |
| 0-50% ultimate breaking strength, % | 93.8 | 115 | 93.3 | 96.3 | 108 | 125 |
| 50-100% ultimate breaking strength, % | 70.8 | 102 | 86.7 | 85.5 | 105 | 120 |
| Average stiffness | | | | | | |
| Initial, lb./in. | 311 | 318 | 325 | 281 | 276 | 304 |
| After 30 days immersion in tap water, lb./in. | 275 | 252 | 327 | 273 | 260 | 284 |
| Retention of initial stiffness, % | 88.5 | 79.3 | 101 | 97.3 | 94.1 | 93.5 |

| *Property* | Laminate No. 35 | 36 | 37 | 38 | 39 | 40 |
|---|---|---|---|---|---|---|
| Finish | Volan A | Volan A | NOL-24 | NOL-24 | NOL-24 (Epoxy) | NOL-24 (Epoxy) |
| Condition | Unstressed | Prestressed | Unstressed | Prestressed | Unstressed | Prestressed |
| Flexural strength | | | | | | |
| Initial, p.s.i. | 67,700 | 75,600 | 76,700 | 79,200 | 75,000 | 86,200 |
| After 30 days immersion in tap water, p.s.i. | 59,400 | 68,400 | 62,300 | 80,000 | 75,300 | 82,000 |
| Retention of initial dry strength, % | 87.7 | 90.4 | 81.2 | 101 | 101 | 95.3 |
| Modulus of elasticity in flexure | | | | | | |
| Initial | | | | | | |
| 0-50%[a] ultimate breaking strength, $10^6$ p.s.i. | 3.32 | 3.53 | 3.43 | 3.36 | 3.10 | 3.53 |
| 50-100%[b] ult. breaking strength, $10^6$ p.s.i. | 2.66 | 2.85 | 2.65 | 2.52 | 2.16 | 2.57 |
| After 30 days immersion in tap water | | | | | | |
| 0-50% ultimate breaking strength, $10^6$ p.s.i. | 3.83 | 3.63 | 4.21 | 4.04 | 4.02 | 4.09 |
| 50-100% ult. breaking strength, $10^6$ p.s.i. | 2.99 | 2.81 | 3.14 | 3.08 | 2.39 | 2.84 |
| Retention of initial modulus | | | | | | |
| 0-50% ultimate breaking strength, % | 115 | 103 | 123 | 120 | 130 | 116 |
| 50-100% ultimate breaking strength, % | 113 | 98.7 | 129 | 122 | 110 | 110 |
| Average stiffness | | | | | | |
| Initial, lb./in. | 251 | 294 | 1071[c] | 1697[c] | 1072[c] | 1630[c] |
| After 30 days immersion in tap water, lb./in. | 239 | 227 | 1031[c] | 1645[c] | 780[c] | 1724[c] |
| Retention of initial stiffness, % | 95.1 | 77.2 | 94.5 | 97.0 | 71.9 | 106 |

[a] Represents modulus based on slope of 0 to 50% ultimate breaking strength part of load deflection curve
[b] Represents modulus based on slope of 50 to 100% ultimate breaking strength part of load deflection curve
[c] Span lengths were 2 in.; all others were 4 inches.

first few laminates fabricated. It was apparent that the modulus of elasticity of the plastic laminate was too low. The laminates thus formed were highly arched and exhibited poor physical properties. In order to obtain a flat laminate, prestressing elements were located on each side of the neutral axis and as far away as possible from it. The product, fabricated in this manner, was flat and this design was followed for all the laminates used in the remainder of the work.

## Test procedures

The physical properties were determined according to the following methods described in Federal Specification L-P-406b, "Plastics, Organic: General Specifications, Test Methods," dated 27 September 1951:

| *Property* | *Method No.* |
|---|---|
| Tensile strength | 1011 |
| Compressive strength | 1021 |
| Flexural strength | 1031 |
| Flexural modulus | 1031 |
| Shear strength | 1041 |
| Impact strength | 1071 |
| Specific gravity | 5011 |
| Glass content | 7061 |

The wet strength retention was

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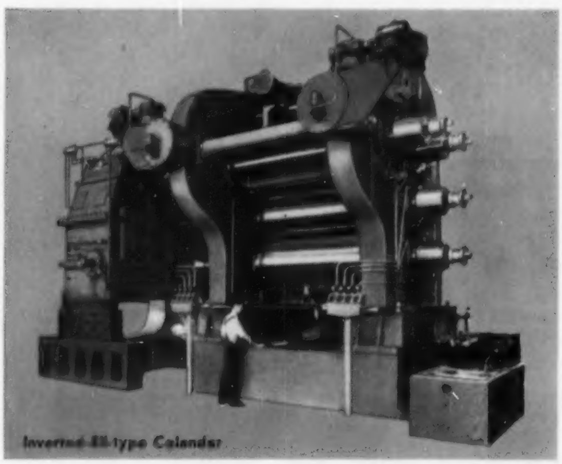

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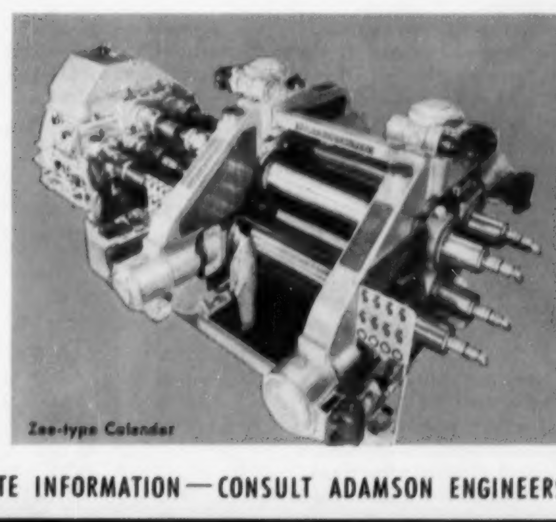

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**Table IV:** Comparison of results of tests of laminates after prestressing and aging

(All footnotes appear at end of Table, p. 159

| *Property* | 2 | 4 | 6 | 8 | 11 | 16 |
|---|---|---|---|---|---|---|
| Lay-up | | | | | | |
| Top component (stressed)[a] | | 1(PSM)[b] | 2(PSM)[b] | 2(660B)[c] | 2(1000-114) | 4(128-114) |
| Center component (unstressed)[a] | 5(M503) | 5(M503) | 5(M503) | 4(184-114) | 10(1000-114) | 13(128-114) |
| Bottom component (stressed)[a] | 1(PSM-2) | 1(PSM)[b] | 2(PSM)[b] | 2(660B)[c] | 2(1000-114) | 4(128-114) |
| Weave of prestress material | Parallel strand | Parallel strand | Parallel strand | Parallel strand | Square | Square |
| Glass fiber, wt. % | — | 50 | 55 | 63 | 60 | 59 |
| Prestress, p.s.i. | 2000 | 3500 | 5100 | 2400 | 2000 | 5200 |
| Immediate change in properties due to prestressing | | | | | | |
| Flexural breaking strength, % | −32 | +39 | + 7 | +12 | +38 | +68 |
| Flexural strength, % | −28 | +33 | +14 | − 4 | +18 | +32 |
| Modulus of elasticity in flexure | | | | | | |
| 0-50%[f] ultimate breaking strength, % | | +27 | 0 | −14 | + 9 | −14 |
| 50-100%[g] ultimate breaking strength, % | | | | | | |
| Average stiffness, % | | | | | +39 | +34 |
| Aging time, hr. | | | | | 14,100 | 13,100 |
| Changes in properties of prestressed laminates after aging (based on initial properties) | | | | | | |
| Flexural breaking strength, % | | | | | +27 | +54 |
| Flexural strength, % | | | | | +10 | +24 |
| Modulus of elasticity in flexure | | | | | | |
| 0-50% ultimate breaking strength, % | | | | | + 8 | −17 |
| 50-100% ultimate breaking strength, % | | | | | — | — |
| Average stiffness, % | | | | | +33 | +28 |

| *Property* | 18[d] | 20[e] | 22 | 24 | 26 | 28 |
|---|---|---|---|---|---|---|
| Lay-up | | | | | | |
| Top component (stressed)[a] | 1(184-114) | 1(184-114) | 1(184-114) | 3(143-114) | 3(143-114) | 1(143-114) |
| Center component (unstressed)[a] | 4(184-114) | 4(184-114) | 4(184-114) | 9(143-114) | 9(143-114) | 5(M503) |
| Bottom component (stressed)[a] | 1(184-114) | 1(184-114) | 1(184-114) | 3(143-114) | 3(143-114) | 1(143-114) |
| Weave of prestress material | Satin | Satin | Satin | Undirectional | Undirectional | Undirectional |
| Glass fiber, wt. % | 60 | 69 | 78 | 69 | 75 | 43 |
| Prestress, p.s.i. | 3800 | 5500 | 5500 | 10,000 | 9600 | 1700 |
| Immediate change in properties due to prestressing | | | | | | |
| Flexural breaking strength, % | +20 | +35 | +58 | +23 | +57 | +66 |
| Flexural strength, % | +16 | +35 | +50 | +26 | +50 | +43 |
| Modulus of elasticity in flexure | | | | | | |
| 0-50%[f] ultimate breaking strength, % | − 1 | + 3 | + 9 | + 6 | −14 | +130 |
| 50-100%[g] ultimate breaking strength, % | +29 | + 0 | +12 | 0 | — | — |
| Average stiffness, % | +20 | +47 | +13 | − 5 | − 8 | +19 |
| Aging time, hr. | 5280 | 5180 | 5200 | | 8700 | 8950 |
| Changes in properties of prestressed laminates after aging (based on initial properties) | | | | | | |
| Flexural breaking strength, % | +20 | +55 | +79 | | +39 | +37 |
| Flexural strength, % | +15 | +43 | +52 | | +41 | +20 |
| Modulus of elasticity in flexure | | | | | | |
| 0-50% ultimate breaking strength, % | − 3 | − 4 | −13 | | −17 | +158 |
| 50-100% ultimate breaking strength, % | +20 | + 2 | −13 | | — | — |
| Average stiffness, % | +12 | +42 | +24 | | −16 | +19 |

(Table IV Continued on p. 159)

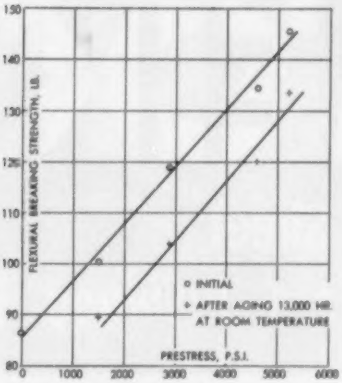



**Fig. 2:** Flexural breaking strength *versus* prestress of 128-114 laminates

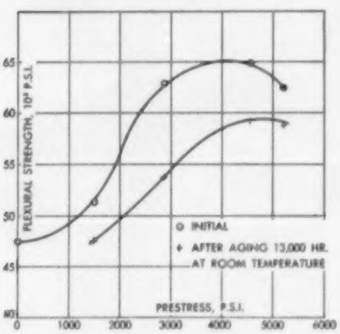



**Fig. 3:** Flexural strength *versus* prestress of 128-114 laminates

determined by comparing the strength of the dry laminate to the strength of the laminate after immersion in tap water for 30 days at 73.5° F., tested while still wet.

The specimens were aged by storing them in a room maintained at a temperature of 73.5° F. and a relative humidity of 50 percent.

Usually five specimens were used to determine the value of each property. In most cases two flexural moduli were calculated for each specimen. Two secants were drawn on the load-deflection curve, one from zero load to 50% of the breaking strength and one from 50 to 100% of the ultimate breaking strength. The two flexural moduli for each specimen were then calculated from the slope of these secants.

Average stiffness was reported as the ratio of the maximum load to the corresponding deflection obtained during the flexural strength test on a specimen with a width of 0.500 in. and a span of 4 inches.

Flexural breaking strength was reported as the load required to break the specimen obtained during the flexural strength test. This load was corrected to the load

(*To page* 162)

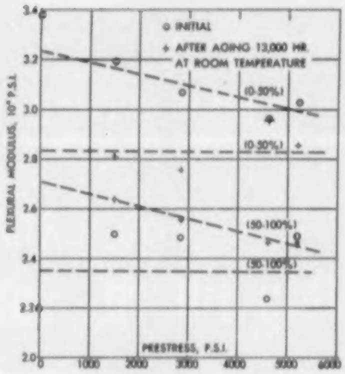



**Fig. 4:** Modulus of elasticity in flexure *vs.* prestress of 128-114 laminates

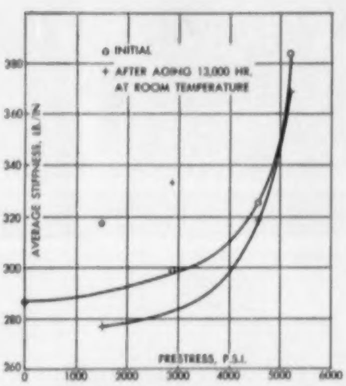



**Fig. 5:** Aver. stiffness *vs.* prestress, 128-114 laminates

**Table IV:** Comparison of results of tests of laminates after prestressing and aging (Cont'd. from page 158)

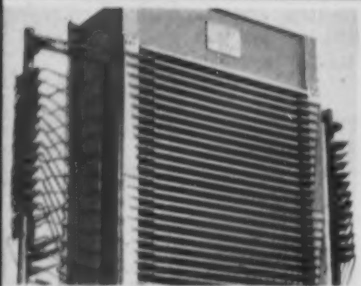
| *Property* | 30 | 32 | 34 | 36 | 38 | 40[h] |
|---|---|---|---|---|---|---|
| Lay-up | | | | | | |
| Top component (stressed)[a] | 3(181-114) | 3(181-136) | 3(181-Garan) | 3(181-Volan A) | 3(181-NOL 24) | 3(181-NOL 24) |
| Center component (unstressed)[a] | 9(181-114) | 9(181-136) | 9(181-Garan) | 9(181-Volan A) | 9(181-NOL 24) | 9(181-NOL 24) |
| Bottom component (stressed)[a] | 3(181-114) | 3(181-136) | 3(181-Garan) | 3(181-Volan A) | 3(181-NOL 24) | 3(181-NOL 24) |
| Weave of prestress material | Satin | Satin | Satin | Satin | Satin | Satin |
| Glass fiber, wt. % | 67 | 66 | 66 | 67 | 64 | 70 |
| Prestress, p.s.i. | 3700 | 3500 | 3800 | 3500 | 3500 | 4200 |
| Immediate change in properties due to prestressing | | | | | | |
| Flexural breaking strength, % | +11 | −12 | −21 | +23 | +43 | +32 |
| Flexural strength, % | +16 | − 3 | −14 | +12 | + 3 | +15 |
| Modulus of elasticity in flexure | | | | | | |
| 0-50%[f] ultimate breaking strength, % | + 8 | + 2 | − 6 | + 6 | − 4 | + 2 |
| 50-100%[g] ultimate breaking strength, % | +14 | − 4 | 0 | +10 | − 2 | +19 |
| Average stiffness, % | + 2 | −14 | −10 | +10 | +61 | +121 |

[a]Number of layers of unstressed or stressed component
[b]Parallel-strand mat, Owens-Corning Fiberglas Corp.
[c]Parallel-strand mat, Facile Corp.
[d]Paraplex P-43
[e]Laminac 4115
[f]Represents modulus based on slope of 0 to 50% ultimate breaking strength part of load deflection curve
[g]Represents modulus based on slope of 50 to 100% ultimate breaking strength part of load deflection curve
[h]Epon 828 plus meta-phenylenediamine

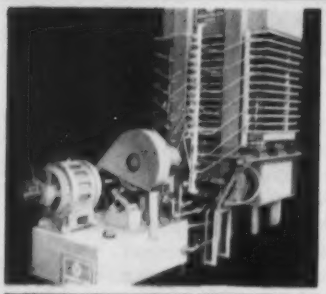
THE WORLD'S LARGEST MANUFACTURERS OF HYDRAULIC HOT PRESSES

# "MEIKI"

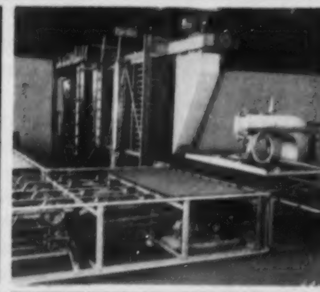
## For Laminate, Hard Vinyl Sheet, Chip Board, Hard Board, Soft Board, Plywood, Etc.



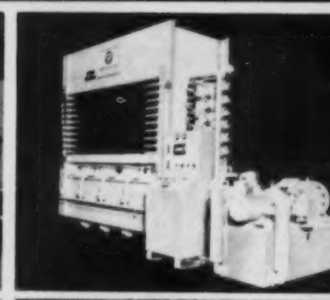
1 600 ton Plywood Press 25 openings



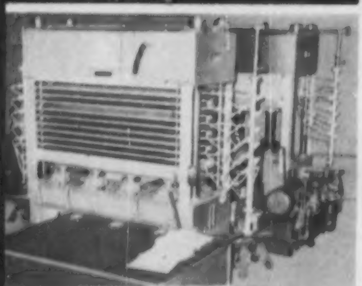
2 500 ton Hardtex Press 12 openings



3 Hardboard Press with Loading Equipment



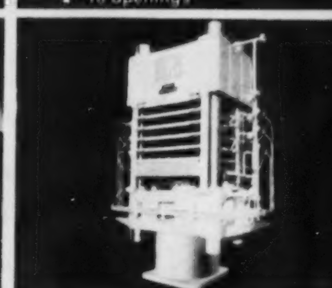
4 500 ton Plywood Press 10 openings



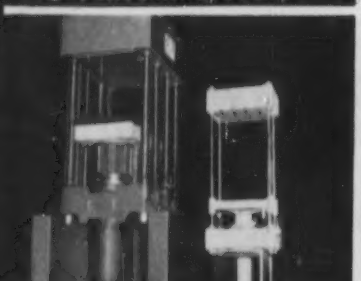
9 300 ton Texboard Press 2 sets driven by a Pump

10 2000 ton Hardboard Press in operation

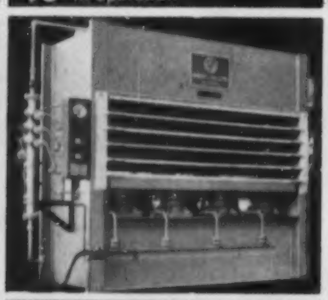
11 1300 ton Hardboard Press 10 openings 4 columns



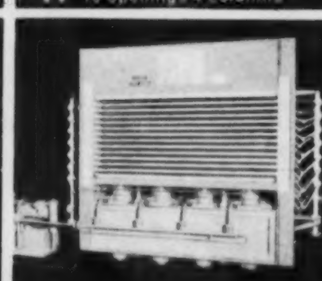
12 1000 ton Laminate Press 5 openings



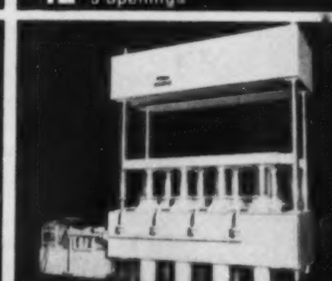
13 3000 ton Press Under Erection



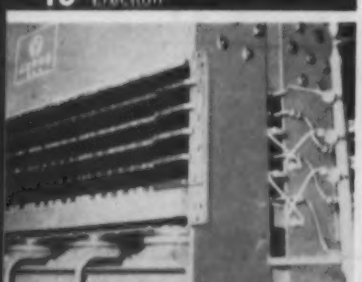
14 500 ton Plywood Press Foundation needless



15 500 ton Plywood Press 13 openings



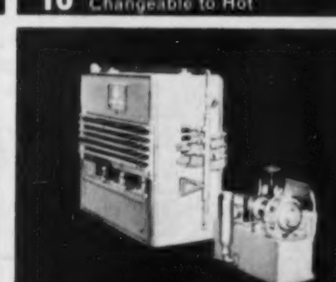
16 400 ton Cold Press Changeable to Hot



17 Multi-bolted Frame Convenient for dis- and re-assembly

18 Twin-set Presses viewed from Loading Side

19 Suited for Furniture Makers Foundation needless

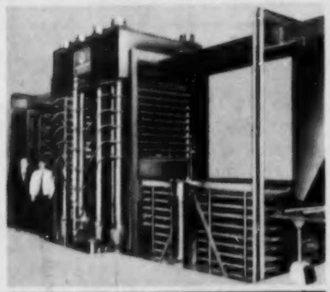


20 300 ton Presses at Laboratory

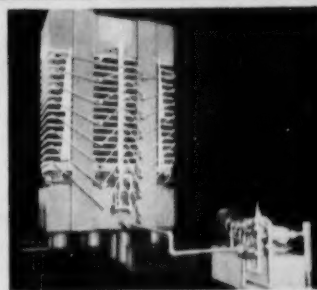
# HOT PRESS

## Backed by Over 20 Years' Specialized Technique in Hydraulic Hot Press

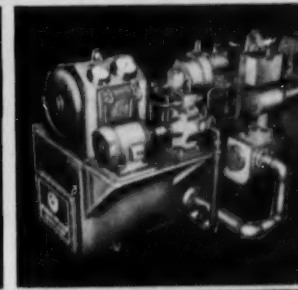
5 400 ton Cold Press Changeable to Hot



6 1800 ton Hardboard Press 10 openings 8 columns



7 500 ton Masalight Press 15 openings



8 Hydraulic Unit for Hot Press

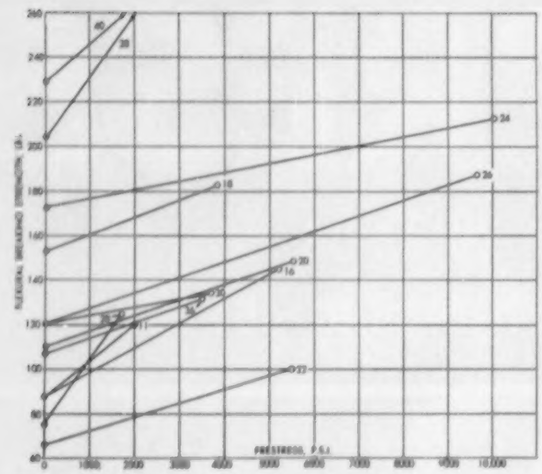


**Fig. 6:** Flexural breaking strength *versus* prestress of laminates fabricated with various weaves of glass fiber reinforcements

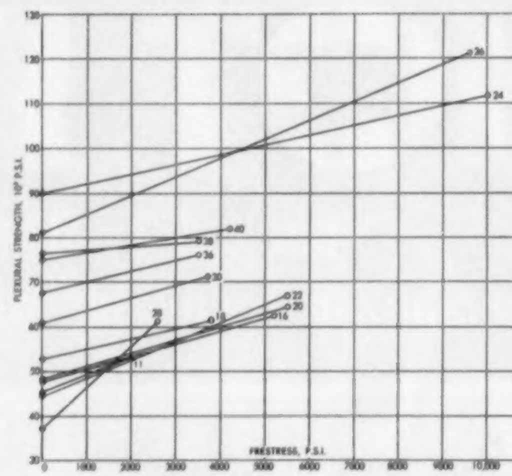


**Fig. 7:** Flexural strength *versus* prestress of laminates that were fabricated with various weaves of glass fiber reinforcements

that would have been required if the width had been exactly 0.500 inch.

## Results of tests

The laminates investigated are described in Table II, p. 154. The results of the tests are shown in Tables III (p. 156) and IV (pp. 158 and 159) and Figs. 2 to 15.

*Flexural breaking strength.* In general, prestressing had the effect of increasing the flexural breaking strengths from 11 to 68 percent. Variations in percentage increase were usually due to differences in the degree of applied prestress. Figure 2, p. 159, shows the variation of flexural breaking strength with prestress of laminates fabricated with 128-114 cloth. The curve is a straight line. Figure 6, above, shows a similar curve for each type of prestressing material used. Most of the curves had similar slopes, indicating that the degree of prestress was the governing factor, all other things being equal. The aging curve in Fig. 2 had the same slope as the initial curve but differed from it by a fixed amount.

*Flexural strength.* The results obtained with the flexural strength tests closely followed the pattern of the flexural breaking strengths, the increases ranging from 16 to 50 percent. Figure 3, p. 159, shows the variation of flexural strength with prestress for 128-114 laminates. The curve displayed a maximum around a prestress of 4000 p.s.i. The aging curve followed the initial curve in general shape but was beneath it by almost a fixed amount. Figure 7, above, shows a flexural strength versus prestress curve for laminates fabricated with the use of cloths of different weaves. Most of the slopes of the curves were quite similar.

*Flexural modulus.* Conflicting results were obtained in the evaluation of the effect of prestressing on the flexural modulus. Figure 4, p. 159, shows modulus decreased in the 0 to 50% ultimate breaking strength range with an increase in prestress in laminates using 128-114 cloth. The modulus did not change in the 50 to 100% range. Figure 8, p. 163, showing flexural modulus versus prestress in the 0 to 50% range for all the laminates, gives mixed results. However, laminates that show decreases in the 0 to 50% range improve somewhat in the 50 to 100% range (Fig. 9, p. 163). Likewise, those laminates that showed initial increases in the 0 to 50% range showed greater increases in the 50 to 100% range.

*Average stiffness.* Figure 5, p. 159, shows that the average stiffness increased exponentially with the degree of prestress. The values of the aged specimens were lower than those of the unaged specimens, but the curve representing aged specimens appeared to approach the curve for the unaged specimens at the higher prestress levels. Figure 10, p. 163, shows that, in general, the average stiffness increased with an increase in prestress.

*Wet strength.* The wet strength retention of all the laminates evaluated (Nos. 29 to 40) appeared to be improved by prestressing. Of much interest was the increase in wet strength of the cloth with the 114 finish, which averaged approximately 59% in the unstressed condition. Prestressing increased this figure to 89.5 percent. It would appear that the process of prestressing, by its squeezing action, closed up avenues of water penetration. Although the laminates fabricated from the cloths with the 136 and the Garan finishes showed no improvement in flexural strength due to the prestressing, their wet strengths were improved by the prestressing. The results obtained with Volan A indicated an increase of a few percent in wet flexural strength, but a decrease in flexural modulus and average stiffness. The other finishes displayed increases in moduli and average stiffness.

*Significance of flexural breaking strength and average-stiffness.* It is believed that the flexural breaking strength and average-stiffness, as defined herein, more nearly portray the strength properties of prestressed plastics, than do the flexural strength and the flexural modulus. Prestressed reinforced plastics are complete in-

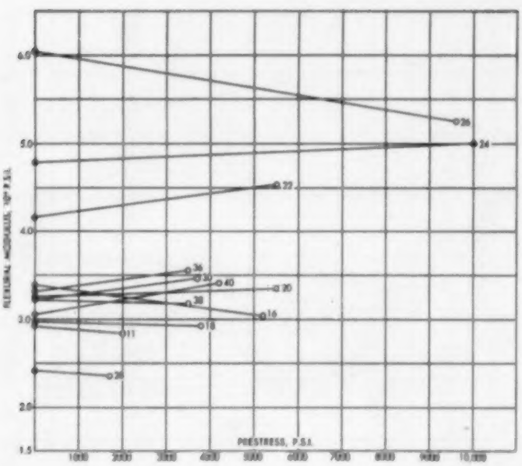



**Fig. 8:** Flexural modulus *vs.* prestress of laminates made with various glass weaves. (0 to 50% ultimate breaking strength range)

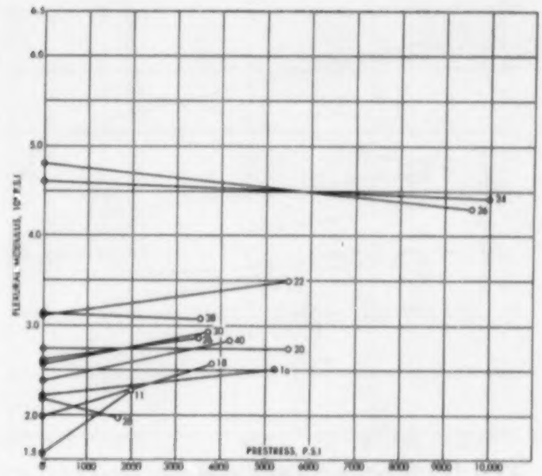



**Fig. 9:** Flexural modulus *vs.* prestress of laminates with different glass weaves. (50 to 100% ultimate breaking strength range)

## Legend for Figs. 6 to 10

| *Laminate No.* | *Cloth No.* |
|---|---|
| 11 | 1000-114 |
| 16 | 128-114 |
| 18 | 184-114, 60% glass |
| 20 | 184-114, 69% glass |
| 22 | 184-114, 78% glass |
| 24 | 143-114, Paraplex P-43 |
| 26 | 143-114, Laminac 4115 |
| 28 | 143-114, M 503 |
| 30 | 181-114 |
| 36 | 181-Volan A |
| 38 | 181-NOL 24, Paraplex P-43 |
| 40 | 181-NOL 24, Epon 828-CL |

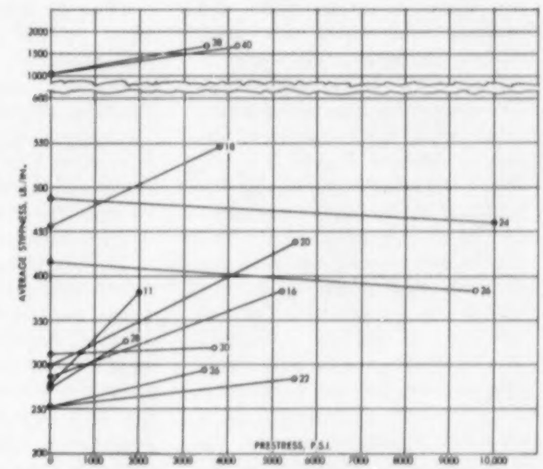



**Fig. 10:** Average stiffness *versus* prestress of laminates fabricated with various weaves of glass fiber reinforcements

tegral units in themselves and cannot be subdivided along the axis of the reinforcement materials without destroying their prestressing feature. Thus, flexural strength and modulus have limited significance when it is realized that the value of these properties cannot be transferred to similar materials of different thicknesses. In the derivation of the mathematical expressions for flexural strength and flexural modulus used in this work, the presence of homogeneous material was assumed. Glass-reinforced plastics do not fall into this category of materials, but closely resemble reinforced concrete. When reinforced concrete was developed, it was found that mathematical expressions for flexural strength and flexural modulus were not pertinent. Formulas were developed that satisfied the requirements of the reinforced concrete structure and showed the relation between the bending moment and stresses in the steel and concrete. Unfortunately, no such formulas are presently available for prestressed reinforced plastics.

### Factors affecting results

*Position of prestressing elements.* If flat specimens are required, the prestressing elements must be equidistant from the neutral axis and stressed equally. If this is not done, curved specimens similar to Laminate 2 will be obtained.

*Type of prestressing element.* Two general types of prestressing elements were used: parallel-strand mat and woven cloth. The parallel-strand mat had a construction that varied widely in glass fiber distribution. Consequently, uniform results were not obtained. All the test work was accomplished with 0.5 in. thick specimens. If the specimens had been wider, it is believed more uniform results would have been obtained and definite proof of the

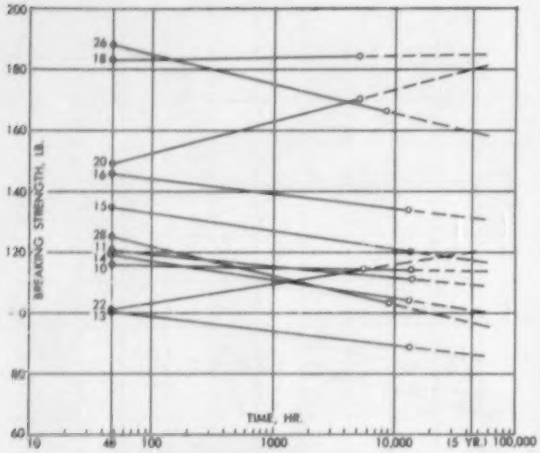



**Fig. 11:** Flexural breaking strength *versus* time of aging of prestressed laminates

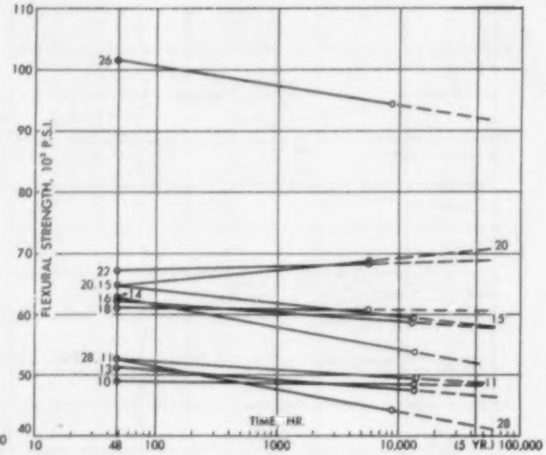



**Fig. 12:** Flexural strength *versus* time of aging of prestressed laminates

effect of prestressing forthcoming. Cloths of square, satin, and unidirectional weave were used, without significant differences.

*Number of layers prestressed.* The greater the number of layers prestressed, the better were the results obtained. Figure 2, p. 159, shows the effect of increasing the prestress by increasing the number of layers prestressed. This should not be confused with the problem that might arise if a choice were available as to whether a definite prestress should be obtained by either prestressing one set of elements a large amount, or several sets of elements a smaller amount. No laminates were fabricated to determine the answer to this question. It is probable that the effect of prestressing elements close to the neutral axis (center in this work) would be smaller than the effect obtained if they were farther away. It is believed that much of the potential increase in strength was lost due to the difficulty involved in lining up the prestressing elements and bonding them so that there would be no slack. The greater the number of prestressing elements used, the greater was the potential loss.

*Degree of prestress.* The degree of prestress appeared to affect most properties. Its greatest effect was felt on the flexural breaking strength, flexural strength, and average stiffness. These properties appeared to increase with increasing prestress. The tensile and impact strengths appeared to increase by a small amount. The effect on the flexural modulus was doubtful. The shear and compressive strengths, flat and edgewise, seemed to decrease.

*Structure of unstressed reinforcement.* The structure of the unstressed reinforcement affected not only the properties of the unstressed laminate, but also those of the prestressed laminate. Together with the prestressing elements, they represented the take-off point for either an improvement or decrease in the various properties concerned. In most of the cases, both the unstressed reinforcement and the prestressing elements were of the same cloth construction. In such cases, the slopes of the curves were similar. In one case, laminate 28, a random mat M503 was used as the reinforcement material and 143-114 cloth was employed as the prestressing element. The results were spectacular in that for this laminate the slopes of most of the prestress curves of properties versus prestress were much higher than the slopes of the curves representing properties of other laminates. This might be attributed to the low properties of the laminate initially, which in turn were due to the fact that the unstressed reinforcement material was a chopped fiber mat.

*Laminating resin.* Several commercial grades of polyester resins and one epoxy resin were used. Both types of resins produced laminates that showed significant increases in their flexural properties when prestressed. Only one set of laminates was fabricated using an epoxy resin to evaluate the NOL-24 finish.

*Percentage of glass.* The prestress appeared to have a greater effect on laminates with high percentage of glass than those with low percentage of glass. Lamiates 18 to 22 were fabricated to determine the effect of the percentage of glass in the laminates. Unfortunately, laminate 18 varied in respect to prestress, so that it could not be included in the comparison without reservations. Laminates 20 and 22 offered, nevertheless, a basis for comparison. A study of these results indicates that an increase in the percentage of glass increased the flexural breaking strength, and flexural strength.

Examination of the variation of flexural breaking strengths and flexural strengths of unstressed specimens with percentage of glass (laminates 17, 19, and 21) indicates that as the percentage of glass increases, the magnitudes of these properties decrease. Prestressing reversed this trend for the flexural strength but not for the flexural breaking strength. The total glass content in laminates 17 to 22 remained constant. The thickness decreased with increasing percentage of glass.

*Finish on glass fibers.* Cloth coated with the 114 finish, Volan A, and NOL-24, produced im-

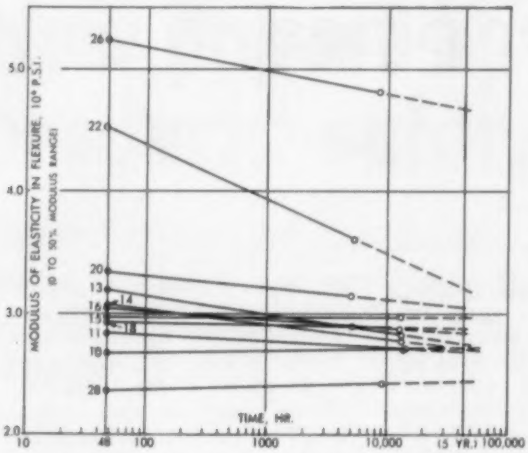



**Fig. 13:** Modulus of elasticity in flexure *versus* time of aging of prestressed laminates

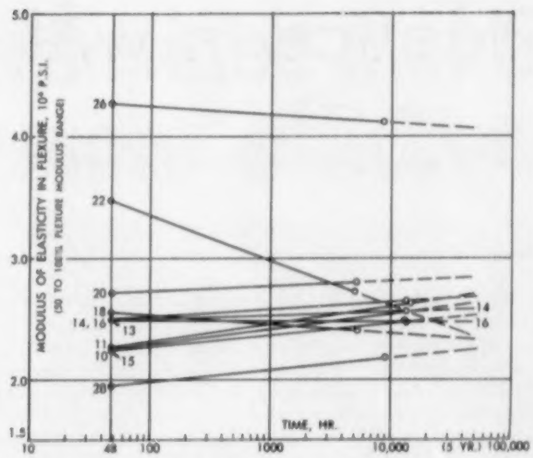



**Fig. 14:** Modulus of elasticity in flexure *versus* time of aging of prestressed laminates

**Legend for Figs. 11 to 15**

| *Laminate No.* | *Cloth No.* |
|---|---|
| 10-11 | 1000-114 |
| 13-16 | 128-114 |
| 18 | 184-114, 60% glass |
| 20 | 184-114, 69% glass |
| 22 | 184-114, 78% glass |
| 24 | 143-114, Paraplex P-43 |
| 26 | 143-114, Laminac 4115 |
| 28 | 143-114, M 503 |
| 30 | 181-114 |
| 36 | 181-Volan A |

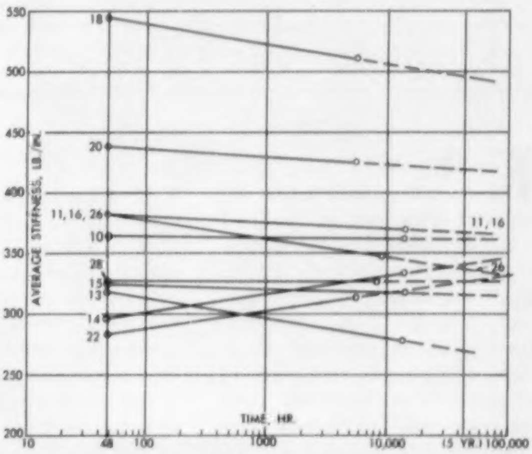



**Fig. 15:** Average stiffness *versus* time of aging of prestressed laminates

provement due to prestressing. Cloth coated with 136 and Garan-type finishes, showed decreases due to prestressing. This was reminiscent of the results obtained with laminate 8 fabricated with glass fiber 660B. The prestressing element used in that laminate was a polyester-bonded parallel-strand mat coated with short fibers which in turn were bonded to the parallel-strand mat with a vinyl adhesive. It is believed that the thermoplastic nature of the vinyl adhesive, and the resulting high creep, prevented the prestressing elements from maintaining their prestress. Wet-strength tests showed that the 136- and Garan-finished cloths were of a quality normally considered to be good by the industry, since their wet strength retentions were 90.4 and 98.8%, respectively.

*Direction of measurement.* Measurements made in the direction of prestress gave optimum results. The results obtained perpendicular to the direction of prestress, were lower than those obtained in the same direction on unstressed specimens. No work was performed to determine the magnitude of the results if tested at some intermediate angle, but it is assumed that they will be intermediate. It is believed that if the laminates are prestressed in two directions, the strength might increase in both directions. The results discussed here are based on tests of 184 cloth laminates only. It is possible that better results would be obtained with thinner and lighter cloths such as 181 when tested in a direction perpendicular to the prestress.

*Aging.* Table IV shows the results of aging on a number of laminates that displayed increases due to prestressing. One group of laminates (18 to 22) showed little or no loss due to aging. This group was fabricated with 184-114 cloth and Paraplex P-43. The other groups of cloth laminates lost approximately 20 to 30% of their original gains. Laminate 28, which has a random mat core, lost over 40% of its

*(To page 265)*

# Plastics in water pipes

*By Walter D. Tiedeman, M.C.E.**

During the past three or four years an extensive study has been carried on by the National Sanitation Foundation at the school of Public Health, University of Michigan, to determine the suitability of plastic pipe for the underground transmission of cold water for drinking water supplies. By "suitability" is meant freedom from toxicity and from deleterious effects on the water such as encouragement of growth of organisms, introduction of discoloration, tastes or odors, or interference with maintenance of chlorine residuals or with the disinfection of pipelines. By "plastic pipe" is meant the 22 formulations included in this study. An effort was made to include all types in common use for drinking water plus a few experimental samples. The results of the study show that plastic pipe of the types commonly recommended for use with potable water supplies is satisfactory for such use and does not make the water toxic, unsightly, unpalatable, nor introduce difficulty in maintaining chlorine residuals nor in disinfecting new pipelines.

The work described in this report was conducted by the National Sanitation Foundation. The Foundation is a nonprofit corporation supported by contributions largely from industry. However, it is managed by a Board of Trustees consisting of influential and impartial men from many walks of life who have no personal interests at stake. The purpose of the Foundation is to carry on much-needed research in sanitation, lack of which has caused confusion, and to promote uniformity of requirements in that field. Through the courtesy of the Board of Regents of the University of Michigan, the Foundation is housed at its School of Public Health.

The study of plastic pipe was financed to a large extent by grants from the Society of the Plastics Industry. Much credit is due an Advisory Committee consisting of experts representing public health and industry. The members were sanitary engineers R. J. Faust, C. W. Klassen, O. J. Muegge, B. A. Poole, and J. H. Svore; Dr. R. A. Saxvik; and representing industry, E. M. Adams, P. S. Britton, W. E. Jacobson, W. E. McCormick, and J. S. Whitaker. This Committee gave much advice, reviewed progress reports during the course of the study, and served as an editorial committee for the complete final report now due off the press.

This study was designed to answer the fundamental question as to whether, from the standpoint of maintaining the quality of the water and adequately protecting the public health, designing engineers should consider the use of plastic pipe in potable water supplies. Some have declined to use it either on their own initiative or on the advice of state regulatory officials largely for want of this basic information. Secondarily, designing engineers also are interested in the physical characteristics of various types of plastic pipes. This is being covered in another laboratory by a separate study, which also is sponsored by the Society of the Plastics Industry.

Sooner or later in this discussion the question is going to be asked "What do you mean by plastic?" Defined broadly it could include many things. *Webster's New Collegiate Dictionary* defines it as "any of a large group of organic, synthetic, or processed materials that are molded or cast and used for making many kinds of small articles, cabinets, airplane bodies, etc., in varnishes, etc., and as a substitute for glass. Some are cellulose derivatives, some proteins, and many are resins formed by chemical con-

**Pipe sections** after removal from acid soil in which the lower halves were buried for one year. Left to right: copper, galvanized steel, and the four plastics showing the most pronounced effects

This paper was presented at a meeting of the American Society of Civil Engineers in Dallas, Texas, on February 17, 1956.

*Executive director, National Sanitation Foundation Testing Laboratory, Ann Arbor, Michigan.

densation or polymerization. Rubber and similar materials (as neoprene) are sometimes included among plastics. Plastics are commonly known by their trademark names." A plastic may have only a few simple ingredients or may contain in addition to a resin or cellulose derivative one or more of such things as coloring material, mold lubricant, plasticizer, antioxidant, accelerator, stabilizer, and filler. Taking into consideration not only permutations and combinations, but also the possibilities for varying percentages of different ingredients, we have a wide variety of products, which make it practically impossible to speak in general terms of plastic pipe. Recognizing this the manufacturers have wisely undertaken a program for placing an easily recognized hallmark on pipe tested and found satisfactory for potable water supply use.

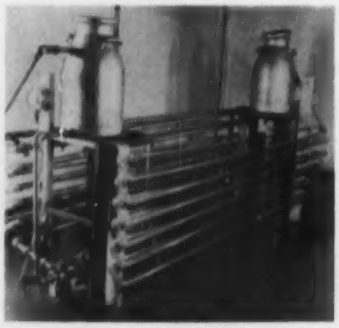
**Types of plastic tested**

The study included three samples of polyethylene pipe, eight samples of pipe classified as rubber-modified polystyrene, five samples of polyvinyl chloride pipe including saran (a polyvinyl-vinylidene), three samples of cellulose acetate butyrate, all recommended for water supply use. In addition, there were for comparison three special samples not recommended for water supply use, one of polyethylene electrical insulation material, and two of polyvinyl chloride—one containing a complex lead compound and the other cadmium and barium salts. This made the total of 22 samples tested. Incidentally, the report contains an appendix which gives simple methods for differentiating these general groups of plastics by flame test and by specific gravity. For instance, polyethylene pipe floats in fresh water.

**Reactions with environment**

Tests were performed to determine possible reactions between plastic pipe and its use environment, particularly air, water, and soil. Similar sections of galvanized steel and copper pipe were used as controls.

*Aggressive test water:* Early in this work a search was made for an aggressive natural water. This work showed that Ann Arbor water, which is treated and chlorinated, is as aggressive as any of the natural waters of a group selected for such qualities as low or high pH, high chlorides, high naturally occurring fluoride, hardness, high mineral content, high sulfates, and high carbonates. It was found that Ann Arbor water could be made more aggressive in the extraction of heavy metals from plastic by lowering the pH through the introduction of carbon dioxide gas. A pH of 5.0 was used because it was felt that water of lower pH would not be used for a potable supply without adjustment. This water was used throughout the work for the water contact and extraction tests.



**System** of plastic pipe and galvanized steel pipe control used in water recirculation tests

*Effects of weathering:* To test the air contact, prepared sections of the samples of plastic pipe were exposed to natural weathering for a period of one year under standardized conditions. There were slight changes in color in a number of instances and a fine surface film formed on the samples of rubber-modified polystyrene.

*Effect of soil:* Test specimens buried in an acid soil of pH 2.0 and held at 35° C. for one year, with intermittent wetting and drying to simulate rainfall using distilled water, showed very little effect on any of the test plastics. This soil was obtained from the grounds of a chemical plant at which an underground line of galvanized steel pipe had been attacked by the soil to the point of developing leaks within a year after it was laid. Some discoloration of samples was noted and also a tendency to form a thin film at the soil plastic interface. By comparison, the section of copper pipe similarly buried showed considerable oxidation and deposition of film while the galvanized steel specimen showed pronounced deposits at the soil-metal interface.

*Effect of water with air interface:* Specimens of plastic pipe held partially immersed in the test water in sealed large-capacity glass-stoppered bottles for one year at 35° C., showed slight color changes, slight film formation and, in some instances, a slight fungus growth. In comparison, the copper tubing under identical conditions showed a fine black sediment and the specimen of galvanized steel pipe was covered with a heavy white floc.

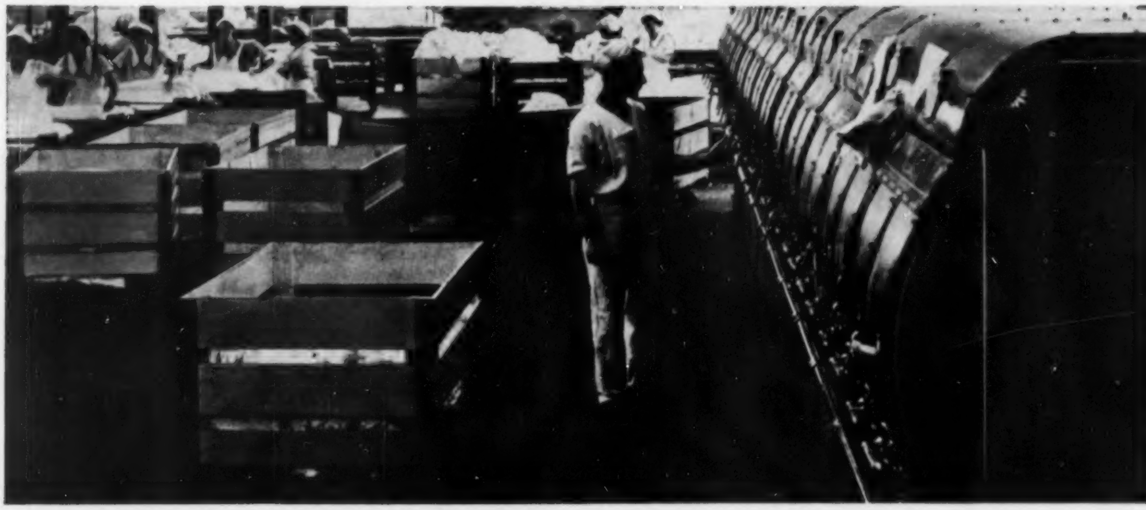
*Susceptibility to rodent attack:* Well controlled experiments indicate that plastic pipe in all four classifications is susceptible to rodent attack when it obstructs access of the rats to food. This was most pronounced with polyethylene, probably because of the softer nature of this formulation. Plastic pipe was attacked by both *Rattus norvegicus* and *Rattus rattus.* There was no evidence that they ate or gnawed the plastics in preference to other substances.

**Extraction tests**

A procedure was developed for subjecting cut specimens of plastic pipe to extraction by aggressive water. The results of these extractions showed that it was impossible to extract any deleterious substances from any of the tested samples that were recommended by the manufacturers for domestic water supply use. This was true even though the pH of the water used was lowered artificially to about 5.0 to make it more aggressive. Natural waters do have pH values as low as 5.0

In order to demonstrate that the water used was aggressive enough to extract some substances from plastic pipe, special samples were prepared, one a polytheylene electrical insulation compound (No. 130) and another a polyvinyl chloride compound (No. 280)

(*To page* 173)



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containing lead and cadmium. Enough color was extracted from the sample containing electrical insulation compound to increase the color of the test water from 0 to 35 (orange-brown). From the polyvinyl chloride sample containing lead, 0.34 mg. of lead per liter were extracted using the test water at its natural pH of 9.6, and 1.25 mg. per liter were extracted when the pH was lowered to 5.0. It should be noted, however, that less than 6% as much lead was extracted from the polyvinyl chloride pipe with water pH 9.6 than from lead pipe under similar conditions.

As further evidence of the aggressiveness of the test water, special samples were prepared containing varying quantities of lead, cadmium, and barium of much greater magnitude than that likely to be used in making plastic. The standard aggressive water, following the standardized procedure, extracted 2.40 p.p.m. of lead from one specimen and 3.90 p.p.m. from a specimen containing twice as much lead. Similarly 0.15 p.p.m. of cadmium were extracted from one special specimen containing cadmium and barium, and 0.30 p.p.m. from a sample containing twice as much cadmium. No barium detectable by the test method was extracted.

Routine chemical examinations of water, after exposure to various plastics, showed no significant changes when compared with similar examinations made on unexposed test water.

**Taste and odor**

In the taste and odor studies, samples of water that had been in contact with cut plastic pipe for three days at 35° C. with occasional agitation were submitted for examination to a five-member panel selected for acuteness in differentiating odors and tastes. As controls, samples of the unexposed test water, of water exposed to copper pipe, and of odor-free water were added to those to be examined. All were simply numbered at random and were submitted to the panel as unknowns.

The results showed no greater intensities of odors, as determined by the standard threshold odor test, in any of the samples exposed to plastic pipe than in the controls. Panel members described the odor and also the taste, although it is recognized that odor necessarily influences taste. The characteristics of the odors and tastes appeared to be about the same for the standard water and copper exposed controls as for the waters exposed to plastic pipes. There was a tendency to describe the odors and tastes as chemical or medicinal which may be due, to some extent, to the fact that the test water was chlorinated.

It should be remembered that exposure conditions were purposely severe in these tests and probably will not be duplicated under any actual use conditions.

Additional odor and taste tests were run on samples of test water that had been recirculated in systems of plastic pipe. This was done in order to introduce the possible effects of fittings and of compounds used in joining the pipe and fittings, and to simulate a water supply system. Two differences which increased the severity of the test were that the water was at room temperature and was recirculated, being alternately pumped for 30 min. and allowed to stand quiescent for 30 min. throughout the three- to seven-day period of exposure. None of the samples tested gave threshold odors greater than the controls or abnormal odors or tastes with one exception.

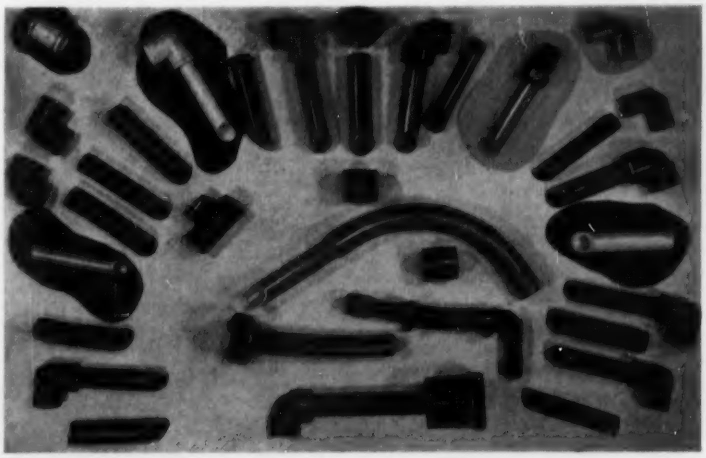
In this latter instance, on first trial, the highly volatile solvent or the cement used for making joints in the cellulose acetate butyrate system following manufacturer's instructions gave a pronounced undesirable odor and taste to the recirculated water. The threshold number was 150. However, after the system was emptied and air run through for several hours, followed by flushing with water, a repetition of the test gave odors and tastes similar to the controls. Nevertheless, the empty system, after standing several days, gave off the characteristic odor of the solvent. It is understood that the manufacturer is changing the solvent.

**Effect of chlorine residuals**

In tests to determine the effect, if any, of plastic pipe on chlorine residuals in water it was found that in no instance was the reduction in free chlorine residual so rapid as to materially change the effectiveness of the chlorination of tap water.

**Disinfection of pipe systems**

Recirculating systems of each of the four general types of plastic pipe under study were heavily seeded with cultures of *E. coli*. After prolonged exposure this was drawn off and the system subjected to disinfection using approximately 200, 50, and 25 p.p.m., respectively, of hypochlorite. After 15- to 24-hr. contact with the circulated chlorine solution, it was discarded, the system flushed with fresh tap water,
*(To page 270)*



**Plastic fittings** and sections of plastic pipe tested

# Epoxy-ether resins: a new technology

*By E. G. Shur**

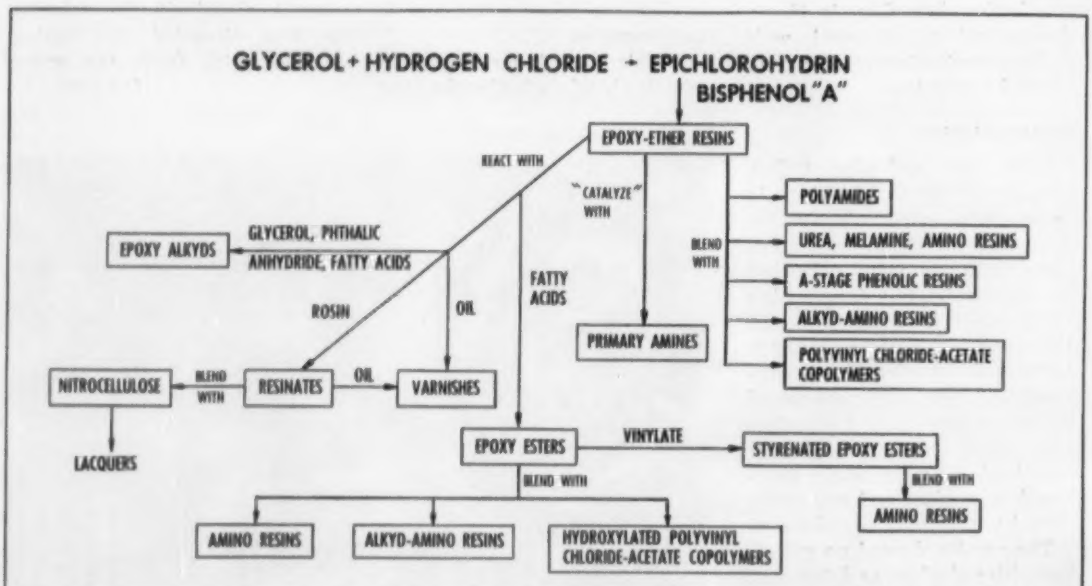
In the course of this half century, the chemists, chemical engineers, and technicians of the protective-coatings industry have seen many dramatic changes: the emergence of a measurable science from a qualitative art; an almost overpowering increase in the multitude of raw materials available; a swift succession of eras in which the dominance of one particular type of industrial coating has overshadowed the field—oil, treated oils, varnishes, synthetic varnish resins, nitrocellulose, ester gum, alkyds, amino resins, and now epoxy-ethers.

The basic raw materials for the manufacture of these resins have been known for almost a century. Berthelot prepared epichlorohydrin by boiling glycerol with hydrogen chloride in glacial acetic acid and saponifying with alkali. Epichlorohydrin became a chemical of commerce available in large quantities in the forties, as a result of the development of a process for its synthesis from petroleum. Resinous products are prepared by reaction with 2,2-bis-(p-hydroxyphenyl) propane (bisphenol A).

The basic properties of these resins stem directly from their chemical structure. The polymer chain consists of carbon to carbon and carbon to ether-oxygen linkages interspaced with the benzene ring and reactive hydroxyl and epoxy groupings. These latter two are spaced far enough apart to impart flexibility when cross-linked. The ether linkage is stable and more resistant to saponification than the ester would be. Etherification has also reduced the color sensitivity of the phenolic hydroxyl.

The initial reaction of the resin upon heating in the presence of a suitable catalyst at 400° F. or above involves opening of the terminal epoxy rings. Further reaction takes place through the secondary hydroxyl groups which may also be esterified. The resins may be cured by reaction with primary alkyl amines at low temperatures or with amino resins at higher temperatures. The conventional baking vehicle containing 70% epoxy-ether resin and 30% urea-formaldehyde resin exemplifies this type. Such a cold blend may actually be catalyzed with organic acids such as benzenesulfonic or p-toluenesulfonic acids, but the reactions are difficult to control and the resultant

*Synthetic Finishes Lab., Finishes Div., Interchemical Corp.




**Block diagram of epoxy-ether** resin technology, showing extensive scope of intermediate and end products

films are more brittle and less resistant than those formed by reaction with amines. This reaction with amines is more effective when lower-molecular-weight resins are used because of the higher ratio of epoxy groupings per gram equivalent weight. However, a practical lower limit on the size of the reacting resin molecule is set by difficulties encountered in application and because of poor control of the enhanced reactivity.

**Cure without oxidation**

Solutions may be prepared in blends of polar, oxygenated solvents such as the ketones, ether-alcohols, and esters with aromatic hydrocarbons. Clarification through a Sparkler-type filter is recommended to remove occluded insoluble impurities. Ethylenediamine is recommended for use in air-dried and forced-dry finishes for temperatures up to 140° F., but is too volatile to be effective above that temperature. Diethylenetriamine is recommended for use at higher temperatures, but is more prone to "sweat" if used at the lower temperatures. This "bloom" or "blush," constitutes one of the major deficiencies of this type of finish. The addition of small percentages of amino resin will frequently help minimize poor wetting, "catalyst bloom," and cratering. These finishes, which may be "catalyzed" or, more accurately, reacted at room temperatures, permit the application of heavy films that cure without oxidation to yield tough, resistant, insoluble films which approach the best properties of conventional baked finishes.

However, it is the urea resin-modified type that offers a higher order of chemical resistance, toughness, distensibility, and mar-proofness. Unfortunately, these finishes have their disadvantages: they are relatively high in cost; they require expensive solvents; their light stability is inferior to the alkyd-amine types; they chalk quickly on outdoor exposure; they are poor wetters on surfaces that are not perfectly free of non-polar impurities such as oils and greases; when pigmented, they require minimal temperatures of 375° F. for cure.

Every attempt to minimize these defects results in some other compromise in properties. For example, the use of acid catalysts, as mentioned above, is generally unsatisfactory since the acid functions primarily to accelerate the cure of the urea resin alone and not to catalyze the cross-linking reaction which yields the desired toughness and maximum resistance. The amine-reacted air-dry finishes are generally inferior to the high-baking types in color retentivity and other chemical resistance properties. There is no current commercially feasible method of eliminating this light sensitivity although it has been reported that catalytic hydrogenation of the benzene ring, at high temperatures and pressures in the presence of a suitable catalyst, has been successful on a laboratory scale.

The epoxy-ether resins are also compatible with phenol-formaldehyde resins of the A-stage type, which contain reactive methylol groups. Such systems will usually cure at somewhat lower temperatures than the epoxy-urea blends described above. The phenolic combination is also generally superior in chemical, water, salt spray, solvent, soap, and detergent resistance. In these mixtures the epoxy-ether resin upgrades the flexibility, toughness, and alkali resistance of the phenolic, whereas the latter improves the salt spray, water, and acid resistance. The primary deficiencies of this system type are poor color, which restricts formulation to finishes such as primers where attractive appearance is not important, and poor stability, as well as those defects of the epoxy-urea systems already given in the paragraph above.

The properties of these three combinations of epoxy-ether resins with 1) primary amines, 2) urea-formaldehyde resins, and 3) phenol-formaldehyde resins would in themselves have been enough to make the epoxy-ethers an outstanding raw material for the protective and decorative coating industry. However, that is not the end of their versatility. It is possible to cold-blend the lower-molecular-weight resin with alkyd-amino resin mixtures. The net effect here is generally to upgrade corrosion and water resistance at intermediate baking temperatures such as 325 to 375° F. Films baked at 300° F. are usually not upgraded since the temperature is too low effectively to cross-link the epoxy-ether modification, in which case it acts as a hard resin additive to improve gloss and adhesion. Its use in this way, of course, necessitates a change in the solvent system to include polar solvents. At concentrations in excess of about 15% of the vehicle solids, the light stability of non-drying alkyd-amino resin combinations will begin to show marked indications of deterioration.

**Heat stabilizers**

The terminal epoxy groups may function as active acid acceptors, hence the low-molecular-weight resin will serve as an excellent heat stabilizer for polyvinyl chloride-acetate copolymers when used at low concentrations. It is completely compatible with the hydroxylated polyvinyl chloride-acetate copolymer and therefore may successfully be used here both as a stabilizer and as a resinous modifier.

We have now added two more combinations of epoxy-ether resins with 4) alkyd-amino resins and 5) polyvinyl chloride-acetate copolymers, and still have not exhausted the versatility of this resin. The epoxy-ether resins contain both epoxy and hydroxyl groups and therefore may be considered chemically as resinous alcohols. These will react with fatty acids to form a wide range of esters which are hydrocarbon and oil soluble. The esterification reaction may be carried out using either open or closed kettles at temperatures near 480° F. The medium-molecular-weight resin is recommended for use with the reactive fatty acids such as dehydrated castor and linseed types. The higher molecular weight resins should be used with the slower cooking acids, such as soya or cocoanut types, since the resin itself has been prepolymerized to a greater degree. Contrary to the procedure normally used in alkyd cooking, temperatures of 500° F.

*(To page 274)*

# Plastics Digest*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

**General**

*Plastics and resins—annual review.* E. E. McSweeney and E. L. Kropa. Ind. Eng. Chem. *48*, 22A-23A, 26A-27A (Jan. 1956). Developments in plastics and resins during 1955 are reviewed.

*Coatings—annual review.* H. Burrell. Ind. Eng. Chem. *48*, 28A-29A (Jan. 1956). Developments in coatings during 1955 are reviewed.

**Materials**

*Acrylic stretch.* Chem. Week 77, 42 (Nov. 5, 1955). The commercial production of stretched transparent acrylic plastic sheets is announced.

*Epoxy esters as plasticizers and stabilizers for vinyl chloride polymers.* L. P. Witnauer, H. B. Knight, W. E. Palm, R. E. Koos, W. C. Ault, and D. Swern. Ind. Eng. Chem. *47*, 2304-11 (Nov. 1955). A new class of primary epoxy plasticizers, epoxidized diacetomonoglycerides, was prepared from fats and studied as possible plasticizers for polyvinyl chloride. Certain of these are comparable or superior to di(2-ethylhexyl) phthalate and are light stabilizers. None was effective as a heat stabilizer. The commercially available epoxidized oils and esters were also examined. To broaden the study and obtain information on the relationship of structure to plasticizing ability, approximately 25 additional compounds were prepared. The outstanding members of this last group, with respect to low-temperature characteristics and efficiency, are 2-ethylbutyl epoxystearate, epoxidized butyl esters of tall oil, and methoxyethyl, acetoxyethyl, glycidyl, tetrahydrofurfuryl, cyclohexyl, phenyl, and benzyl epoxystearate.

*Properties of styrene-polyester copolymers.* J. M. Church and C. Berenson. Ind. Eng. Chem. *47*, 2456-62 (Dec. 1955). Polyester resins were initially prepared from maleic anhydride and triethylene glycol with polymerization to various acid numbers, ranging from 25 to 100, representing varying degrees of polymerization. Each of these resins was then copolymerized with a different amount of styrene, 8 to 31% by weight, to produce a series of copolymers from each polyester resin possessing a range of physical properties. Correlations established between the chemical composition and the physical and chemical properties of the copolymer resins allow prediction of properties to be expected in similar copolymer compositions. Copolymer resins prepared from the polyester resins with acid numbers within the range 25 to 50 were optimum in physical and chemical properties; acid numbers greater than 65 gave resins of poor physical and chemical characteristics. The better of these styrenated polyester resins possess properties indicating their possible use in surface coatings and casting resins.

*Cure of carbon black-unsaturated polyester mixtures.* C. W. Sweitzer, F. Lyon, and T. S. Grabowski. Ind. Eng. Chem. 47, 2380-85 (Nov. 1955). Carbon black has been reported to inhibit the cure of polyester plastics. It is shown that with the use of certain promoters, such as resorcinol, dimethylaniline, and p-dimethylaminobenzaldehyde, carbon black acts as an accelerator. By proper choice of promoter and temperature a range of curing times may be obtained. Carbon black prolongs the shelf life of the resin. The cured resins have better weathering resistance. Qualitative mechanisms of these carbon black-peroxide interactions are described.

*A new material: irradiated polyethylene.* F. J. Bockhoff and J. A. Neumann. Chem. Eng. *62*, 228, 230, 232, 234 (Sept. 1955). Methods of preparation, mechanisms involved, and properties of irradiated polyethylene are discussed. Although any type of high-energy radiation can accomplish the same end result, electron bombardment appears to be the most feasible type of commercial treatment. The absorption of energy breaks chemical bonds at which reunion occurs to form a cross-linked structure. The dosage is important; a relatively small amount of irradiation is required to convert polyethylene to a material that will not melt; greater doses completely suppress cold flow at room temperature; very large doses, beyond the beneficial range, render the material hard and glass-like. A one million-v. electron beam will produce a depth of penetration of about ½ centimeter. Higher voltages increase the depth of penetration in a linear manner. Irradiated polyethylene possesses markedly improved heat resistance, mechanical properties, and solvent resistance while retaining the desirable toughness, flexibility, impact resistance, and excellent dielectric properties of conventional polyethylene. Applications of irradiated polyethylene include laboratory and hospital ware, pipe and tubing, gaskets, insulators, tank liners, and vacuum- or pressure-formed articles. New treatments and new applications are being evaluated continually in this rapidly developing field.

**Molding and fabricating**

*Automatic machine for cast-resin applications.* J. E. Sensi and P. J. Franklin. Electrical Mfg. 56, 166-69 (Sept. 1955). Details of the design, construction, and operation of an automatic machine for cast-resin applications are presented. Its principal advantage is the

* Reg. U. S. Pat. Off.

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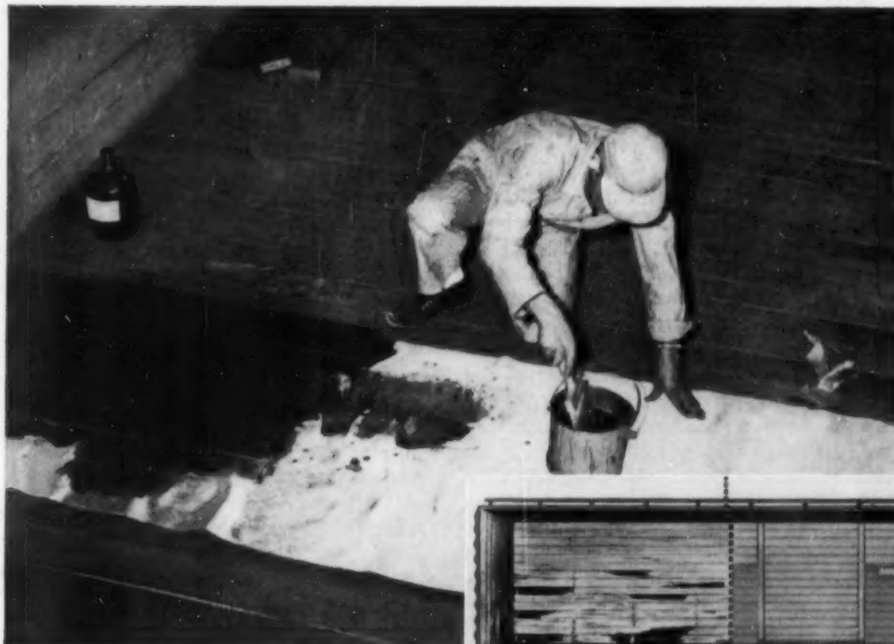

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**Reichhold polyester resin** used in Espey Carliner is applied over glass cloth on floor of freight car. The resin coating goes on easily, dries fast to a hard, durable surface.

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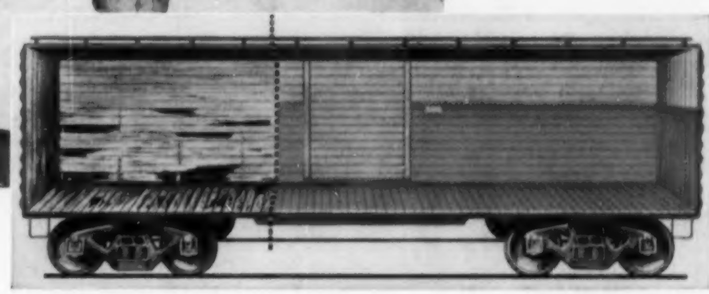

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elimination of short-time wasteful small-batch operation previously imposed by the limited pot life common to most two-constituent resins used in casting. The potting machine comprises three independent systems. 1) A heating system to maintain the resin and catalyst at elevated temperatures to reduce viscosity and speed leveling in a potted or embedded unit. 2) A resin-catalyst mixing chamber where small volumes are continuously mixed as required, thus alleviating the problem of working with premixed batches of resin-catalyst with short pot lives. When the mixing chamber outlet is opened to let the resin flow into the unit to be cast, resin and catalyst in correct proportion flow into the system from the metering pumps to provide a continuous feed. 3) A purging system for solvent-flushing the machine clean of all resin-catalyst mixture when necessary. The machine can be converted from the use of two-component resins to multi-component resins by the introduction of a suitable number of tanks, check valves, and metering pumps.

*Silicone-glass parts by vacuum laminating.* K. Hoffman and E. Elliot. Materials & Methods *42*, 110-12 (Sept. 1955). Vacuum laminating silicone-glass parts is an economical way of producing small quantities of oversize, complex, or experimental parts without the expense of production molds. Unlike polyesters, which are used solvent-free, silicones must be applied to glass cloth in solution (as are phenolics), then precured to drive off the solvent and advance the resin to the laminating stage. The viscosity of a silicone resin at its laminating temperature is about 10 times that of a polyester resin at its laminating temperature. The silicones are condensation resins and give off volatile products during cure. The silicone-glass vacuum laminating process involves the following steps: 1) the glass cloth is saturated with diluted resin, 2) the resin-soaked cloth is laid on the form and precured, 3) a parting blanket and spacing cloth are added, 4) the entire assembly is enclosed in a plastic bag and evacuated, 5) the laminate is smoothed and given a preliminary cure, and 6) all coverings are stripped off and the laminate is given a final cure (12 hr. at 480° F. for the laminate described in this article).

*Polymerization control in casting thermosetting resin.* W. R. Dial, W. E. Bissinger, B. J. DeWitt, and F. Strain. Ind. Eng. Chem *47*, 2447-51 (Dec. 1955). A method was developed for the control of polymerization of diethylene glycol bis(allyl carbonate), an allyl casting monomer known commercially as CR-39. Because of the highly exothermic nature of the polymerization process, casting of this monomer must generally be carried out at relatively low temperatures and over extended periods of time. Information is developed on the kinetics of catalyst decomposition. Special rising temperature polymerization cycles are defined which produce a constant rate of catalyst decomposition and polymerization, thus resulting in a constant rate of heat evolution. Cycles of twelve hours' total duration are practicable for sheet castings of ¼-in. thickness. Much shorter cycles can be used to polymerize thinner sections, especially if conditions providing good heat transfer are employed.

**Applications**

*Chemical engineering aspects of the synthetic fibers industry.* G. H. Fremon and R. L. Stultz. Chem. Eng. Prog. *51*, 394-98 (Sept. 1955). Growth curves for the textile fiber industry are presented and an extrapolation into the near future is made. The synthetic fibers growth curve has remained essentially horizontal for the past four years while the textile industry as a whole has suffered a severe recession. Continued long-term growth in markets for the synthetic fibers is indicated, but competition from the natural fibers will be strong because of the general surpluses of farm products. Recent developments in the synthetic fibers industry that appear to be of major commercial importance are the commercial introduction of nylon-6 and the revival of interest in cellulose triacetate fibers. Other fibers new enough to be regarded as recent developments include Vicara (made from zein), Dynel, Orlon, Acrilan, Dacron, and saran. Utilization of continuous-filament yarns avoids the costly textile operations involved in combing out and combining the randomly-oriented short lengths of natural fibers such as cotton and wool. However, functional and taste requirements usually result in the continuous filament being cut into staple fiber, given a suitable crimp, and then put through the conventional textile operations. The low softening points of plasticized acetate and vinyl fibers have been exploited in producing non-woven fabrics made by bonding together (heat-sealing) a web of randomly distributed fibers. An important development in consumer psychology is the growing appreciation of the concept of performance per unit cost.

*Resin-bonded, laminated, and reinforced abrasive products.* P. L. Shanta. Ind. Eng. Chem. *47*, 2495-99 (Dec. 1955). Constructions of various sorts used in the manufacture of reinforced resinoid abrasive products are discussed, and representative figures on important physical properties are given. A survey of physical property values in comparison with those of non-reinforced products shows why the reinforced products provide improved performance, expanded utility, and greater safety.

*Polyester casting resins for rigid insulating parts.* R. G. Black. Electrical Mfg. *56*, 139-42 (Oct. 1955). Examples are given of cast-resin work in electrical components such as terminal strips, cable terminal blocks, and electrical test fixtures. The advantages and difficulties encountered in these applications are reviewed in detail. Advantages of polystyrene-polyester compositions over pressure-molded products include superior insulating quality at elevated temperature and humidity, minimum disturbance of delicate inserts during mold-filling, ability to be cured at relatively low temperatures, high impact resistance

when properly reinforced, practically any desired color, and simpler process facilities. Disadvantages include the relatively high cost of material, high degree of shrinkage (although non-shrinking compounds are available at a premium), longer curing times than for conventional pressure-molded materials, and in some cases, the need for cleaning molds after use. Rapid expansion of applications for polyester resins appears likely because of the availability of ready-catalyzed putty-like compositions that flow well under pressures of 200 to 300 p.s.i., the ability to use cheap, naturally fibrous minerals in place of relatively expensive glass fiber as reinforcement, and the possibilities for "tailor made" compositions for specific applications by judicious combinations of resin and fillers.

## Properties

*Radiation stability of plastics and elastomers.* C. D. Bopp and O. Sisman. Nucleonics *13*, 28-33 (July 1955). Although a low exposure to high-energy radiation improves certain properties of polymers, longer exposures produce deleterious effects. Data are presented to show the effects of length of exposure on many rubbers and plastics.

*How radiation changes polymer mechanical properties.* C. D. Bopp and O. Sisman. Nucleonics *13*, 51-55 (Oct. 1955). Ordinary elasticity, high elasticity, and viscous flow are the mechanisms of deformation of solid polymers. Qualitatively, the effect of radiation on the mechanical properties of polymers can be described by considering the effect of cross-linking and cleavage on these mechanisms. Cross-linking tends to impede viscous flow. The equilibrium value of Young's modulus for high elasticity is directly proportional to the concentration of cross-links, but for ordinary elasticity the sensitivity of the Young's modulus is less for the more rigid materials. Cleavage reduces the yield stress for viscous flow, and decreases the equilibrium value of Young's modulus for high elasticity. the Young's modulus for ordinary elasticity is again insensitive for the more rigid materials. The changes in the mechanical properties of irradiated plastics and elastomers depend upon the rates of cross-linking and cleavage. These rates are governed both by the polymer's chemical structure and by the strength of the van der Waals forces. For uncross-linked polymers, the change in Young's modulus is a measure of the cross-linking rate in the case of the less rigid materials. Sensitivity to chain cleavage has been correlated with chemical structure for the materials studied.

*Permeability of polymer films to gases and vapors.* R. Waach, N. H. Alex, H. L. Frisch, V. Stannett, and M. Szwarc. Ind. Eng. Chem. *47*, 2524-27 (Dec. 1955). Permeability data for cellulose acetate, polyester, nylon, polyethylene, saran, ethyl cellulose, polytrifluoromonochloroethylene, polyvinyl alcohol, and rubber hydrochloride to nitrogen, oxygen, and carbon dioxide are reported.

*Effects of radiation of organopolysiloxanes.* E. L. Warrick. Ind. Eng. Chem. *47*, 2388-93 (Nov. 1955). A study intended to evaluate organopolysiloxane elastomers and resins as materials of construction around radiation sources of high intensity showed that vulcanization of organopolysiloxane elastomers by radiation gave rubbers of superior high-temperature performance. The effects of radiation from four different sources were parallel to those reported recently for a number of organic polymers. The greatest differences were in the precise nature of the chemical effects. The same equivalence of energy, regardless of source, was observed with dimethylpolysiloxanes as for organic polymers. Phenomena already noted on radiating dimethylpolysiloxanes with two types of source were confirmed.

*Dielectric breakdown properties of thermosetting laminates.* N. A. Skow. Trans. ASME 77, 701-04 (July 1955). Thermosetting laminated plastics are used extensively for electrical insulation because of their unusual combination of good electrical, mechanical, and chemical properties. To establish safe operating loads, tests for the endurance limits of dielectric strength were run on each of several grades of thermosetting plastic laminates that had been conditioned at various combinations of time, temperature, and moisture. Plots of voltages against time indicate that for a given thickness and atmospheric condition, a maximum voltage exists below which failure will not occur. Tests of this type yield results that are valuable to the design engineer in determining the proper grade and thickness of material for use as insulating parts in electrical equipment. In selecting the proper laminate, it is important to know the temperature at which the equipment is to be operated, the atmospheric conditions to be encountered, the mechanical strain, and the dielectric stress to be applied. Under dry conditions where mechanical-strength requirements are not severe, paper-base laminates are satisfactory. Under humid conditions, the more water-resistant paper-base grades are desirable. Under dry conditions requiring high mechanical strength, it may be necessary to use a fabric-base grade. Under continuously humid conditions requiring high mechanical strength it may be desirable to use a nylon fabric laminate bonded with phenolic resin. If arc resistance is an important requirement, a melamine-bonded glass-base laminate would be useful.

*Effects of the electrostatic component of adhesion on bond strength.* S. M. Skinner and J. Gaynor. Plastics Tech. *1*, 626-31, 635 (Nov. 1955). It has been shown experimentally that charge separation occurs at break; the adhesive remains charged for considerable periods of time; this charge cannot be removed permanently by surface treatment alone; the measured charges are less than those predicted, but the total charge is unlikely to be measured in tensile break; and the oscillograph trace shows characteristic patterns which depend on the method of preparation of the bond. It appears that use of oscillograph traces taken during

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break may be of value in studying the mechanical behavior of an adhesive bond during the milliseconds of break, and in the setting up of techniques for preparing adhesive bonds in quantity production.

### Testing

*High-speed tension testing machine for plastics.* J. Dorsey, F. J. McGarry, and A. G. H. Dietz. ASTM Bulletin No. 211, 34-37 (Jan. 1956). Apparatus is described for the tension testing of time-sensitive materials such as plastics at high rates of loading. Fracture is obtained in 5 to 15 milliseconds and stress-strain data are recorded. Results for methyl methacrylate plastic are presented.

*Evaluation of the Boor-Quartermaster snag tester for coated fabrics and plastic films.* F. W. Reinhart, C. Brown, L. Boor, and J. J. Lamb. ASTM Bulletin No. 210, 50-59 (Dec. 1955). A method of test to determine the snag resistance of plastic- and rubber-coated fabrics and plastic films is described. This method is based on the Boor-Quartermaster snag tester, a new testing device. The property of snag resistance is determined by three observations, namely, the minimum angle of attack of the needle to tear the material, the energy to tear, and the type of tear. The effects of variables in the machine and the method on the test results are reported. The method is recommended for testing coated fabrics and plastic films but not fabrics alone.

### Publishers' Addresses

*A.S.T.M. Bulletins:* American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.
*Chemical Engineering:* McGraw-Hill Digest Publishing Co., Inc., 330 W. 42nd St., New York 18, N. Y.
*Chemical Engineering Progress:* American Institute of Chemical Engineers, 120 E. 41st St., New York 17, N. Y.
*Chemical Week:* McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 18, N. Y.
*Electrical Manufacturing:* The Gage Publishing Co., 1250 Sixth Ave., New York, N. Y.
*Industrial and Engineering Chemistry:* American Chemical Society, 1115 Sixteenth St., N. W. Washington 6, D. C.
*Materials and Methods:* Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.
*Nucleonics:* McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York 36, N. Y.
*Plastics Technology:* Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N. Y.
*Transaction of the ASME:* American Society of Mechanical Engineers, 29 W. 39th St., New York, N. Y.

# U.S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each

**Resin.** W. E. Leistner, A. C. Hecker, and O. H. Knoepke. U. S. 2,623,965, Nov. 15. Vinyl compositions containing a polyvalent metal salt.

**Siloxane elastomers.** D. C. Youngs (to Dow Corning). U. S. 2,723,966, Nov. 15. Siloxanes produced with dichlorobenzoylperoxide.

**Copolymers.** W. M. Thomas (to American Cyanamid). U. S. 2,723,-967, Nov. 15. Copolymers of an unsaturated polyester and acrylonitrile.

**Interpolymers.** V. L. Folt and E. J. Carlson (to B. F. Goodrich). U. S. 2,723,970, Nov. 15. Interpolymers of a difluorodichloroethylene, a 1,3-butadiene, and an alkyl acrylate.

**Polymers.** M. E. Cupery (to Du Pont). U. S. 2,723,971, Nov. 15. Polymeric phosphates.

**Molding.** S. C. H. Smith (to R. H. Windsor). U. S. 2,724,146, Nov. 22. Injection molding machine.

**Inlaid articles.** J. J. Larmour (to Plastic Inlays). U. S. 2,724,200, Nov. 22. Inlaid plastics.

**Coating.** L. C. Rubin (to M. W. Kellogg). U. S. 2,724,672, Nov. 22. Applying thermoplastic polymer of trifluorochloroethylene to a curved surface.

**Laminated wood.** G. M. Williams (to U. S. Rubber). U. S. 2,724,675, Nov. 22. Bonding wood together with a solvent-free film of phenolic resin modified with cashew nut shell oil.

**Coating.** R. L. Millar (to Glidden). U. S. 2,724,704, Nov. 22. Alkyd-silicone coating compositions.

**Resin.** R. S. Glover, Jr. (to Hercules). U. S. 2,724,705, Nov. 22. Modified polyester resin.

**Vinyl resin.** F. C. Bersworth (to Dow). U. S. 2,724,706, Nov. 22. Heat- and light-stable vinyl chloride resin.

**Molding.** S. P. Kish (to Kish Plastic Products). U. S. 2,724,868, Nov. 29. Plastic casting molds.

**Polymers.** W. D. Niederhauser (to Rohm and Haas). U. S. 2,725,367, Nov. 29. Salts of terpolymers of maleic anhydride, diisobutylene and divinylbenzene.

**Insulation.** J. W. Schell (to Erie Resistor). U. S. 2,725,312. Nov. 29. Electric circuit having a coating of polymerized chlorotrifluoroethylene.

**Laminate.** N. E. Martello (to Westinghouse). U. S. 2,725,321, Nov. 29. Laminated article impregnated with phenolic resin.

**Wall covering.** F. A. Holes (to Dobeckmun). U. S. 2,725,324, Nov. 29. Decorative wall covering.

**Adhesive sheet.** M. Seymour (to B. B. Chemical). U. S. 2,725,325, Nov. 29. Composite protected adhesive plastic film.

**Wrinkle coating.** F. E. Drummond (to New Wrinkle). U. S. 2,725,363, Nov. 29. Corrosion-resistant wrinkle coating.

**Vinyl polymers.** J. Dazzi (to Monsanto). U. S. 2,725,364, Nov. 29. Plasticized vinyl resins.

**Isocyanate resins.** N. V. Seeger and T. G. Mastin (to Goodyear). U. S. 2,725,366, Nov. 29. Storable isocyanate-modified polyesters.

**Resins.** D. D. Reynolds and J. A. Cathcart (to Eastman Kodak). U. S. 2,725,368, Nov. 29. Polyvinylbenzene sulfonyl chlorides and derivatives.

**Copolymers.** P. Robinson (to Sprague Electric). U. S. 2,725,369, Nov. 29. Copolymers of triphenylethylene.

**Copolymer.** J. R. Caldwell (to Eastman Kodak). U. S. 2,725,370, Nov. 29. Copolymer of acrylonitrile and monoallyl ethers of glycerol.

**Polymers.** L. M. Minsk (to Eastman Kodak). U. S. 2,725,372, Nov. 29. Light-sensitive unsaturated esters of polyvinyl alcohol.

**Polyethylene.** R. A. Mosher (to Standard Oil). U. S. 2,725,374, Nov. 29. Polymerization of ethylene.

**Polyacrylonitrile.** A. B. Craig (to Chemstrand). U. S. 2,726,132, Dec. 6. Treatment of polyacrylonitrile with aromatic sulfonic acid half salts.

**Laminates.** B. W. Lew (to Atlas). U. S. 2,726,177, Dec. 6. Impregnating cellulosic stock with a melamine resin and a polyester resin.

**Polymerization.** H. F. Park and C. K. Bump (to Monsanto). U. S. 2,726,204, Dec. 6. Electrolytic polymerization.

**Sponge.** F. B. Hill, Jr. (to Du Pont). U. S. 2,726,219, Dec. 6. Polyalkylene ether glycol-arylene diisocyanate elastomer sponge.

**Acrylonitrile.** F. F. Ogden (to Monsanto). U. S. 2,726,220, Dec. 6. Shaped articles of cyanoethyl cellulose and polyacrylonitrile.

**Resins.** P. A. Talet (to Societe Nobel). U. S. 2,726,223, Dec. 6. Modified polyester resin.

**Polyvinyl acetate.** I. Pockel (to Cambridge Industries). U. S. 2,726,-225, Dec. 6. Polyvinyl acetate plasticized with a polyester resin.

**Composition.** R. L. Werkheiser (to Monsanto). U. S. 2,726,226, Dec. 6. Composition of polystyrene, butadiene-styrene, and a phosphite ester.

**Polyvinyl chloride.** W. E. Leistner and O. H. Knoepke. U. S. 2,726,227, Dec. 6. Polyvinyl chloride stabilized with tin mercaptides.

**Resins.** R. B. Thompson (to Universal Oil). U. S. 2,726,228, Dec. 6. Unsaturated ketone resins.

**Copolymer.** J. J. Padbury and J. A. Price (to American Cyanamid). U. S. 2,726,229, Dec. 6. Unsaturated guanamine-acrylonitrile copolymer.

**Polymers.** E. J. Carlson (to B. F. Goodrich). U. S. 2,726,230, Dec. 6. Alkyl acrylate polymers.

**Polymers.** E. Field and M. Feller (to Standard Oil). U. S. 2,726,231, Dec. 6. Olefin polymers.

**Polymers.** R. W. Upson (to Du-Pont). U. S. 2,726,232, Dec. 6. p-Xylylene bis (5-cyclopentadiene) polymers.

**Resin.** A. J. Warner and D. K. Keel (to International Tel. and Tel.). U. S. 2,726,233, Dec. 6. Purification of hydrogenated polystyrene.

**Colored materials.** W. Federkiel, H. Pfitzner, and H. Baumann (to Badische Anilin). U. S. 2,726,920, Dec. 13. Colored polyamides and polyurethanes.

**Polyvinyl chloride.** R. I. Longley, Jr. (to Monsanto). U. S. 2,727,013. Dec. 13. Vinyl chloride resin plasticized with dialkyl esters of alpha-aryl glutaric acids.

**Polymers.** R. W. Auten and E. M.

strength gypsum cements manufactured by U. S. Gypsum Co.

Hankins (to Rohm and Haas). U. S. 2,727,015-6, Dec. 13. Polymeric N,N'-alkyleneureidoalkyl acrylamides produced by aminolysis.

**Polymers.** G. H. Berthold (to Olin Mathieson). U. S. 2,727,017, Dec. 13. Polymerization of caprolactam.

**Interpolymers.** R. D. Evans and M. J. Rhoad (to Goodyear). U. S. 2,727,018, Dec. 13. Reaction of a mercapto polymer with an N-acyl lactam of a polycarboxylic acid.

**Polymers.** S. Melamed (to Rohm and Haas). U. S. 2,727,019, Dec. 13. Polymers of N-(vinyloxyalkyl)-imidazolidones.

**Polymers.** S. Melamed and B. F. Aycock (to Rohm and Haas). U. S. 2,727,020, Dec. 13. Polymers of isocyanatoalkyl vinyl ethers.

**Polymers.** J. A. Price (to American Cyanamid). U. S. 2,727,021, Dec. 13. Copolymers of aminoethyl acrylate and acrylonitrile.

**Polymerization.** J. Linsk (to Standard Oil). U. S. 2,727,022, Dec. 13. Polymerizing iso-olefin in isopentane.

**Polymerization.** B. L. Evering, A. K. Roebuck, and A. Zletz (to Standard Oil). U. S. 2,727,023, Dec. 13. Polymerization of ethylene.

**Polymerization.** E. Field and M. Feller (to Standard Oil). U. S. 2,727,024, Dec. 13. Olefin polymerizations.

**Molding.** A. Blumer (to Maschinenfabrik and Giesserei). U. S. 2,727,277, Dec. 20. Heated cylinder on injection molding machines.

**Reinforced plastics.** F. W. Barnett, M. N. Sumner, and J. E. Cashman (to Fulbright, Crooker, Freeman, and Bates). U. S. 2,727,293, Dec. 20. Prestressed reinforced hardened plastic bodies.

**Ethyl cellulose.** W. P. ter Horst (to Olin Mathieson). U. S. 2,727,824, Dec. 20. Ethyl cellulose composition.

**Alkyd resins.** E. M. Beavers and R. S. Urban (to Rohm and Haas). U. S. 2,727,870, Dec. 20. Modified alkyd resins.

**Copolymer.** W. S. Ropp (to Hercules). U. S. 2,727,871-2-3, Dec. 20. Copolymer of vinyl acetate and a vinyl rosin acid ester.

**Polymers.** G. P. Mack and E. Parker. U. S. 2,727,875, Dec. 20. Heat-hardenable siloxane polymers with a tin catalyst.

**Polyblends.** R. L. Ballman and J. M. Chamberlain (to Monsanto). U. S. 2,727,878, Dec. 20. Blends of

polystyrene and butadiene-styrene copolymers.

**Polymers.** H. F. Park (to Monsanto). U. S. 2,727,877, Dec. 20. Thermoset sulfonamide polymers.

**Silicon polymers.** R. N. Hazelwood (to McGraw Electric). U. S. 2,727,880, Dec. 20. Polymers from acetone and trichlorosilane.

**Catalysis.** J. R. Caldwell and J. W. Wellman (to Eastman Kodak). U. S. 2,727,881, Dec. 20. Organo-titanium catalysts for polyesters.

**Polymerization.** J. L. Vodonik (to Du Pont). U. S. 2,727,882, Dec. 20. Polymerization of bis(2-hydroxyethyl) terephthalate.

**Polymerization.** W. L. A. Barth (to Aero Service Corp.). U. S. 2,727,883, Dec. 20. Polymerization of polyalkylene polysulfides.

**Polymerization.** D. L. McDonald, K. E. Coulter, and J. L. McCurdy (to Dow). U. S. 2,727,884, Dec. 20. Mass polymerization of vinylidene compounds.

**Cellulose derivatives.** A. L. Allwelt (to American Viscose). U. S. 2,728,630, Dec. 27. Shaped articles of cellulose phenylthiourethane.

**Cellular plastic.** E. Simon, F. W. Thomas, and L. A. Dixon, Jr. (to Lockheed). U. S. 2,728,702, Dec. 27. Composite cellular plastic.

**Vinyl resins.** J. R. Caldwell (to Eastman Kodak). U. S. 2,738,738, Dec. 27. Plasticized vinyl resins.

**Polymers.** W. D. Jones (to Celanese). U. S. 2,728,739, Dec. 27. Polymers of N-acrylylpyrrolidine.

**Foaming resin.** E. Simon and F. W. Thomas (to Lockheed). U. S. 2,728,741, Dec. 27. Phenolic foaming resins.

**Resins.** F. W. Banes and S. B. Mirviss (to Esso). U. S. 2,728,742, Dec. 27. Upgrading hydrocarbon resins by treatment with divinyl compounds.

**Resin.** C. A. May and E. C. Shokal (to Shell). U. S. 2,728,744, Dec. 27. Compositions of a polyhydric alcohol and glycidyl ethers

**Polymers.** A. C. Smith, Jr. and C. C. Unruh (to Eastman Kodak). U. S. 2,738,745, Dec. 27. N-(p-cinnamoylphenyl) urethanes of hydroxyl-containing polymers.

**Resins.** C. C. Unruh (to Eastman Kodak). U. S. 2,738,746, Dec. 27. Alpha-hydroxy acrylic acid polymers.

**Polymers.** H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak).

U. S. 2,728,749, Dec. 27. Fluoroalkyl vinyl sulfonate polymers.

**Resins.** D. Aelony and M. M. Renfrew (to General Mills). U. S. 2,728,-747, Dec. 27. Polyester resins.

**Polymers.** F. O. Davis (to Thiokol). U. S. 2,728,748, Dec. 27. Polysulfide polymers.

**Copolymers.** A. V. Tobolsky and T. H. Meltzer (to Thiokol). U. S. 2,728,750, Dec. 27. Copolymers of cyclic disulfides and unsaturated monomers.

**Copolymers.** W. E. Catlin and B. W. Howk (to Du Pont). U. S. 2,728,751, Dec. 27. Long-chain acrylic-type ester-amino styrene copolymers.

**Polymerization.** H. C. Brown (to Standard Oil). U. S. 2,728,752, Dec. 27. *tert.*-Butyl ethylene in ethylene polymerization.

**Polymerization.** L. W. Russum, R. L. Hatch, and G. H. Weisemann (to Standard Oil). U. S. 2,728,753-4-5-6-7-8, Dec. 27. Ethylene polymerization.

**Extrusion.** D. B. Hertz and H. Chow (to Celanese). U. S. 2,728,943, Jan. 3. Extrusion apparatus.

**Films.** C. H. Crooks (to Imperial Chemical). U. S. 2,728,944, Jan. 3. Melt-extruded films.

**Reinforced plastic.** D. C. Broughton and E. G. Dueringer (to A. O. Smith). U. S. 2,729,268, Jan. 3. Fiber-reinforced plastic storage structure.

**Ion exchange.** K. Haagen (to Bayer). U. S. 2,729,607, Jan. 3. Cation exchange resin.

**Elastomer.** D. E. Strain (to Du Pont). U. S. 2,729,608, Jan. 3. Chlorosulfonated polyethylene.

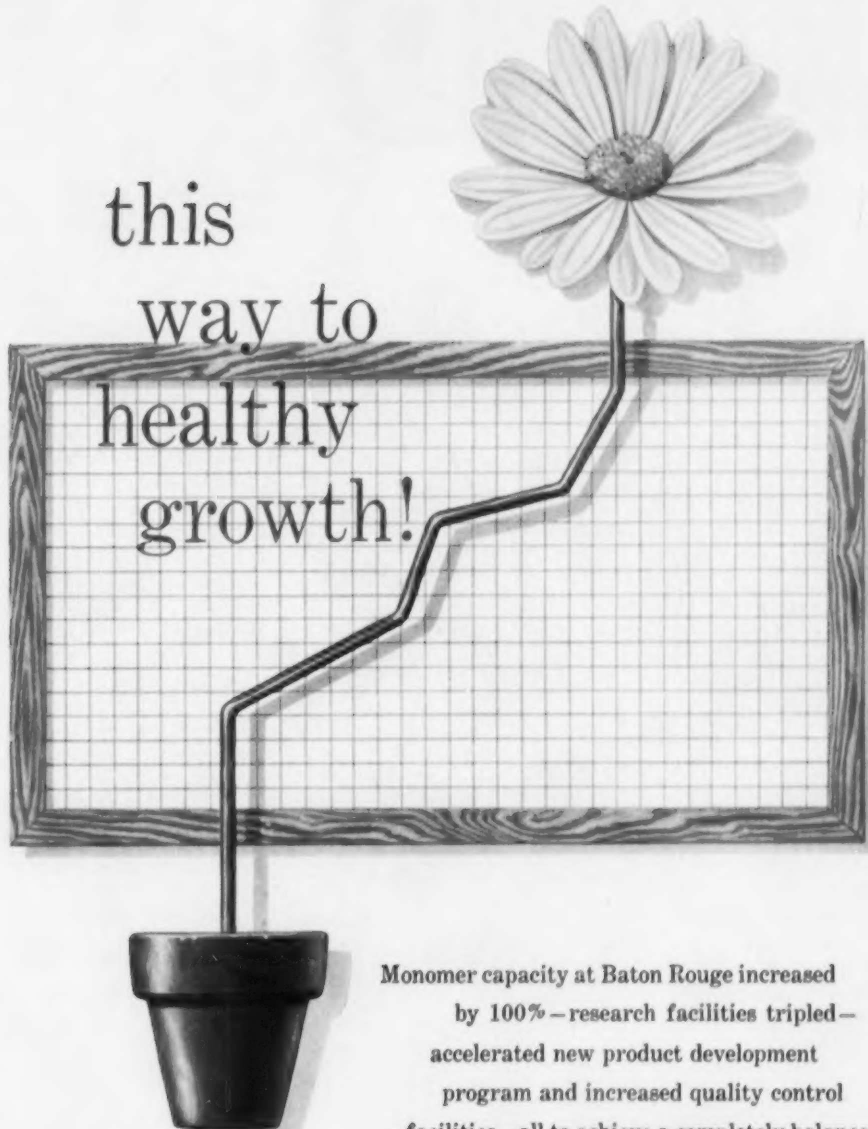
**Resins.** R. W. H. Tess and T. F. Mika (to Shell). U. S. 2,729,609, Jan. 3. Poly *tert.*-alkyl substituted carbocyclic acids in alkyd resins.

**Polymerization.** H. Ehring and K. Raichle (to Bayer). U. S. 2,729,610, Jan. 3. Polymerizing monomeric aromatic vinyl compounds.

**Condensate.** L. C. Chesley, Jr. and R. G. Hart (to Borden). U. S. 2,729,-611, Jan. 3. Urea-formaldehyde resin.

**Polymers.** G. I. M. Bloom, J. E. Duddington, M. F. Vincent, and A. H. Willbourn (to Imperial Chemical). U. S. 2,729,615, Jan. 3. Polymers of acrylic acid derivatives.

**Polymers.** C. J. Albisetti, A. L. Barney, and H. E. Winberg (to Du Pont). U. S. 2,729,622, Jan. 3. Polymers of polycarboxyl quaternary ammonium monomers.

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# New Machinery and Equipment

**Coating machine**

Equipped with semi-automatic friction-demand feed, a new coating machine is said to handle many coating jobs faster and more efficiently. It can coat all kinds of bases from materials as thin as tissue paper to those as heavy as index card, in widths from 1 to 12 inches. Envelope flaps, and labels as short as 2 in. can be handled. *Potdevin Machine Co., 285 North St., Teterboro, N. J.*

**Injection molding machine**

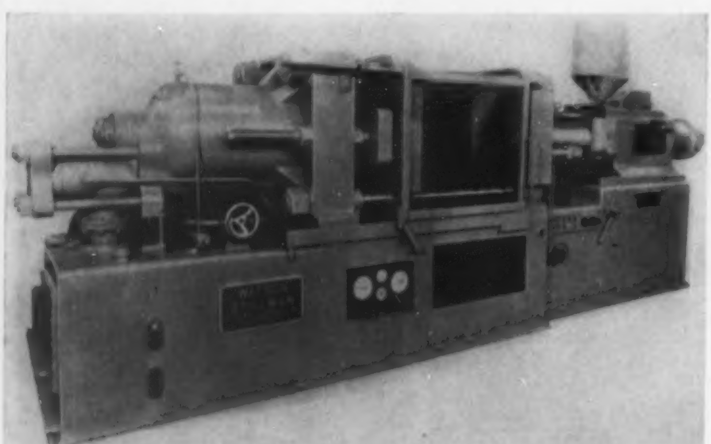
Designed to give faster cycles and high plasticizing rates, the heating cylinder of a new 24-oz. horizontal injection machine features an internally heated torpedo with four-zone heat control for better plasticizing at lower temperatures. The ram is "pre-positioned" so that the mold is filled just after it is clamped. Continuously variable controls of both pressure and ram speed are built in. The maximum shot capacity is raised about 40% by a stuffing arrangement.

The new machine has a base design that makes it easy to reach the pumping unit and piping. The hydraulic system has several improvements for better performance and reduced maintenance. Allowances were made in the design for possible future installation of a preplasticizer to jump capacity from 24 to 90 ounces.

Specifications are:

| | |
|---|---|
| Approximate capacity of hopper (lb.) | 300 |
| Maximum shot size, styrene (oz.) | 24 |
| Shooting injection rate (cu. in./min.) | 1800 |
| Speeds: | |
| Die closing, forward (in./min.) | 675 |
| Die opening, return (in./min.) | 675 |
| Injection, forward (in./min.) | 174 |
| Injection, return (in./min.) | 400 |
| Maximum injection at 20,000 p.s.i. (in./min.) | 174 |
| Stroke of injection plunger (in.) | 14.5 |
| Maximum injection pressure (p.s.i.) | 20,000 |
| Clamping capacity (tons) | 425 |
| Daylight opening (in.) | 40 |
| Minimum die thickness (in.) | 16 |
| Maximum die sizes (in.) | 27 by 45 or 25 by 40.5 |
| Total motor power (hp.) | 70 |
| Floor space (ft.) | 21 by 6.5 |
| Overall-height (ft.) | 8.5 |

The machine is furnished with a standard self-compensating hopper and feeder, but a weigh-feeding mechanism can be provided as additional equipment. *Watson-Stillman Press Div., Farrel-Birmingham Co., Roselle, N.J.*



**Watson-Stillman** 24-oz. injection molding machine is designed with a stuffing arrangement that increases maximum shot capacity

**Slitter-rewinder**

Model TD-4, a two-drum winder with riding roll, is made in widths of 42, 52, and 62 in. and with speed ranges up to 1000 ft./minute. It is equipped with 4-in. diameter drums, has a rewind capacity of 30 in. and can be furnished for score- or shear-type slitting.

The machine, one in a new line of slitter-rewinders being offered by a new manufacturer in the field, incorporates a number of design improvements. They include a riding-roll overdrive insuring tight starts, controlled pneumatic engagement of slitters, and positive axial locking of the core winding shaft.

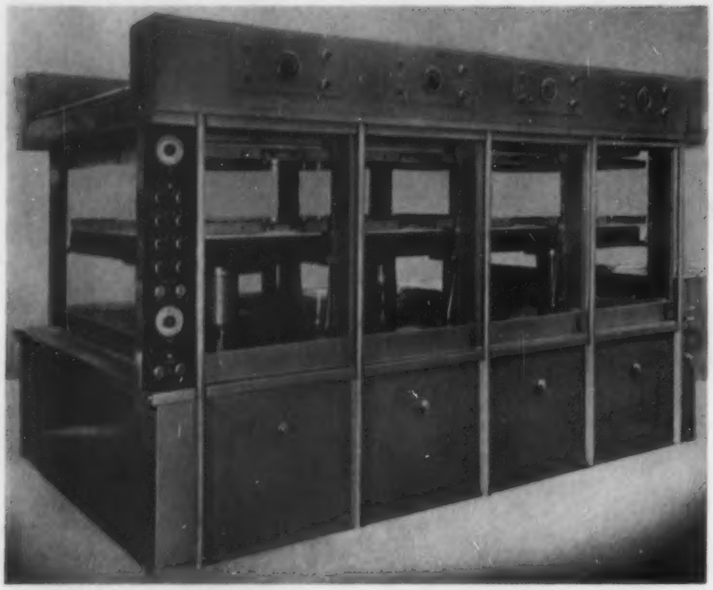
All controls are conveniently located at the front of the machine. Safety features include all-enclosed drive belts and an air brake on the winder drums. Three other models are offered for rolls up to 72 in. in diameter and for widths up to 130 inches. *Dilts Div., Black-Clawson Co., Fulton, N. Y.*

**Elevating loading table**

Designed for loading and unloading multiple-opening presses, Model 130 raises or lowers to any one of two or more preselected press openings. The unit is air-power operated and pushbutton actuated, working on a principle similar to that by which automatic elevators function. Operating levels are adjustable to suit requirements. The equipment is made available in size and load ratings as required by the customer. Either plain or ball transfer table tops can be provided. *Loomis Engineering & Mfg. Co., 126 S. 14th St., Newark 7, N. J.*

**Multi-platen press**

Having a total mold area of 54 by 110 in. a new multi-platen press develops a total pressure of 560 tons with eight 70-ton rams pressing in unison on separate



**Pasadena Hydraulic** multi-platen press is built around eight rams that are capable of developing a total pressure of up to 560 tons

24.5-in. square platens. Each platen has cast-in Calrod heaters and individual controls capable of reaching temperatures of as high as 600° F. The rams have 9-in. strokes with a maximum opening of 18 inches.

A central control panel can coordinate all eight rams or any two groupings of them. Individual controls located at each station permit the machine to be operated as eight independently controlled presses. This versatility of control makes the machine ideal for the smaller operator who wants to be in a position to tackle a wide range of jobs.

The maker will build presses of similar configurations of different ram and platen sizes and combining different numbers of units. *Pasadena Hydraulics, Inc., 279 North Hill Ave., Pasadena, Calif.*

**Laboratory mill**

Model 52LC is a high-speed, three-roll, 4½- by 10-in. mill of laboratory size. It may be operated as a conventional mill with fixed center roll and four-point adjustment or with floating center roll and two-point adjustment. Conversion from one type of operation to the other requires no special tools.

The mill is built as a replica of the larger production-size mills to provide laboratory or pilot-scale duplication of results which are presently obtained on the larger mills.

Detachable apron and top-hinged and removable end plates facilitate cleaning of the machine. *Charles Ross & Son Co., 148 Classon Ave., Brooklyn 5, N. Y.*

**Vacuum gage**

This one- to four-station vacuum gage gives continuous pressure readings from 100 to 0.001 mm. Hg. Called Autovac, it is a self-balancing, direct-reading, hot-wire-type instrument that finds application in vacuum furnaces, stills, metallizers, deyhdration units, and other vacuum processing equipment; it is claimed to cover substantially all laboratory and industrial applications now using Pirani and similar gages.

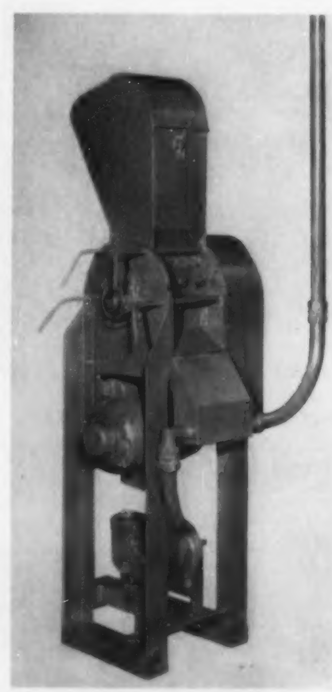
The gage provides automatic switching from the millimeter range (100 to 0.1 mm. Hg) to the micron range (0.100 to 0.001 mm. Hg), with a pilot lamp indicating when the instrument is in the millimeter range. The Autovac can activate an external relay circuit for various purposes (e.g., operation of valves) and has connection for four gage tubes.

The gage circuit contains a resistance-bridge circuit fed from an 800-cycle oscillator. The gage tube wire forms one of the branches of the bridge. The bridge is in balance when the temperature of the wire is about 120° C. Any change of pressure in the tube will cause a change of the wire temperature and consequently of wire resistance, and the bridge will thus become unbalanced. The bridge output is fed to an amplifier which, through a feedback loop, returns the bridge toward balance and the temperature of the wire to its original value. The voltage applied to the bridge, after rectification, is fed to the indicating meter.

Autovac will operate from 110- to 240-v., 50/60-cycle a.-c. lines. The over-all dimensions are 12¼ by 6¾ by 8½ inches. *Consolidated Engineering Corp., 300 North Sierra Madre Villa, Pasadena 15, Calif.*

**Granulator**

Model NBL combination granulator and hopper-loader operates as an independent unit for grinding alongside the molding machine. Material to be ground is fed into the granulator hopper and the granules are pneumatically con-



**Thoreson-McCosh** granulator returns granules to machine hopper

veyed to the feed hopper of the molding machine.

The unit can also be used together with an existing D&W hopper-dryer system. Specifications are as follows:

| | |
|---|---|
| Throat size (in.) | 4.5 by 9 |
| Screen size, standard (in.) | 0.25 |
| Number of knives | 4 |
| Motor, totally enclosed, 220-v., 3-phase (hp.) | 1.5 |
| Floor space (in.) | 30 by 40 |
| Approx. weight (lb.) | 450 |

Also available is the Model A granulator, equipped with material bins and casters. *Thoreson-McCosh, Inc., 18208 W. McNichols Rd., Detroit 19, Mich.*

**Marking equipment**

Two models have been added to the line of Airgrit marking machines. These machines mark plastics, metal, glass, and ceramic surfaces of thin-walled and fragile objects without danger of fracture or distortion. Operating on a forced-blast principle, the machines leave an "etched" impression on the surface of the part by blowing fine abrasive grit through the relieved portions of a rubber mask. Made to customer specifications, masks are interchangeable for different markings. Both the depth of marking and the timing cycle are controllable.

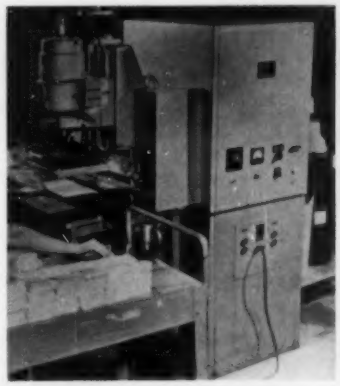
Model 260 contains a single jet blasting nozzle and has a stationary top. It is recommended by the manufacturer for marking small parts at rates of 500 or more per hour. Controlled blast is actuated by foot switch. Maximum working area of this model is ¾-in. diameter, height is 37¼ inches.

The Rollagrit Model is designed for marking of cylindrical parts. Production rates of this model depend on size of part and depth of marking desired. A Microswitch in the handle of the unit controls the blast. Maximum marking area is 3 in. long, height of machine is 42 inches.

Both models operate from 110-v., 60-cycle, single-phase current, require 80 p.s.i. air line, and occupy 18 by 32 in. of floor space. *Jas. H. Matthews & Co., Inc., 3942 Forbes St., Pittsburgh 13, Pa.*

**Heat sealer**

High-frequency dielectric heating is used in a new plastics sealer for vinyl sheeting. Inexpensive dies are made to the desired shape and after tear-sealing, the excess material can be stripped off. The platen design permits a number of products (depending on size) to be sealed at one time. Completely automatic, the machine goes through its entire operating cycle at the touch of a pedal, and is said to be capable of sealing vinyl materials in all thicknesses. Dies can be changed in five minutes. Versatility of manufacturing is provided by controls that select proper heat and regulate cycle timing. The Model 2500 is said to seal a 60- by ⅛-in. bar length on any two pieces of 20-gage vinyl in 1 to 2 sec.; in the same time it will tear-seal or emboss an equivalent area. *Peeco Corp., 2760 Whittier Blvd., Los Angeles 23, Cal.*



**Peeco Corp.** high-frequency dielectric heater seals vinyl sheeting

**Viscosity controller**

Ultra-Viscoson measures viscosities of paints, liquid resins, and reaction masses. The instrument consists of an intermittently excited ultrasonic reed oscillator and a detector that measures the rate of damping. When the reed is inserted into the test liquid, the rate of damping is reported as the product of viscosity and density. Field tests have shown that by using the instrument to control viscosity of paints, for example, the user can reduce painting defects and achieve greater economy.

Used with a solenoid-operated valve, the instrument senses and adjusts automatically for loss of paint solvent by evaporation. It

should find similar uses in controlling resin-melt temperatures and in monitoring viscosities of dispersions and plastisols. *Cincinnati Div., Bendix Aviation Corp., 203 W. Third St., Cincinnati, Ohio.*

**Deep-throat presses**

A new line of presses ranging in capacity from 22 to 150 tons features a front-to-back crankshaft design, completely enclosed drive mechanisms, and, when desired, extra-deep throats. They are designed to perform a variety of blanking, forming, etc., operations as well as combination die and automatic feeding operations. *Niagara Machine and Tool Works, 683 Northland Ave., Buffalo 11, N. Y.*

**Mold polishing kit**

A comprehensive, yet inexpensive, polishing kit contains an assortment of 24 of the most popular Cratex polishing wheels, cones, blocks, and mandrels used for cleaning and polishing molds, dies and castings, removing films, polishing welds, and so on. Included is an instruction bulletin for using these rubberized abrasive wheels. *Cratex Mfg. Co., 81 Natoma St., San Francisco, Calif.*

**Epoxy resin spray gun**

KiPlaGun reportedly cuts costs in resin-coating wood and metals, and in laminating glass cloth. It features an electrically heated element for maintaining proper spraying temperature, a special nozzle that mixes the material just prior to leaving the gun, and a metering device for positive proportioning of materials. It is especially designed for spraying epoxies. *Kish Industries, Inc., 1301 N. Turner St., Lansing, Mich.*

**Tramp iron removal**

The design of a new line of nonelectric Alnico magnets was based on dynamic tests involving fast-moving or entangled specimens, rather than on static lift tests. The rear edge of the magnet's face is recessed so that attracted iron is lifted well out of the passing stream of to-be-cleaned material. *Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee 56, Wis.*

# Books & Booklets

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationary.

**"Salt and Water, Power and People"**

*By Robert E. Thomas*

Published in 1955 by Hooker Electrochemical Co., Niagara Falls, N. Y. 109 pages. A limited number of copies are available free of charge.

Subtitled "A Short History of Hooker Electrochemical Company," this book was written to celebrate the 50th anniversary of the company and to acquaint readers with its growth and progress. The book is divided by chapters into eras, or periods of time, in which important developments took place.

**"Modern Physics: A Textbook for Engineers"**

*By Robert L. Sproull*

Published in 1956 by John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 491 pages. Price: $7.75.

In order to understand many of the modern engineering processes and devices (transistors, nuclear power reactors, etc.), an analysis based upon experimentation and theory is necessary. This book carries such an analysis far enough so that the "new" physics can be applied to understanding processes (thermionic emission, nuclear reactor), instruments (optical pyrometer, mass spectrometer), and properties of materials (ferro-magnetic materials, semi-conductors, etc.).

**"The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names"**

*By Kenneth L. Kelly and Deane B. Judd*

National Bureau of Standards Circular 553, Government Printing Office, Washington 25, D. C. 158 pages. Price: $2.00. (Foreign remittances must be in U. S. exchange and should include an additional one-third of the publication price to cover mailing costs).

The circular is designed to assist in understanding the different color vocabularies used in the fields of art, science, and industry. The dictionary serves not only as a record of the meanings of the 7500 individual color names listed but also enables anyone to translate from one color vocabulary to another.

**"Our Smallest Servants"**

Published in 1955 by Chas. Pfizer & Co., Inc., 630 Flushing Ave., Brooklyn 6, N. Y.

The history of the harnessing of microscopic living organisms in the service of mankind is traced in this book on fermentation. Progress is described from primitive stages to the contemporary period when selected mold organisms are controlled by the biochemical engineer for the production of antibiotics, hormones, vitamins, and many valuable industrial and agricultural chemicals.

Among the many topics discussed are Pasteur's research into microbial life, Chaim Weizmann's use of a bacterial cousin of the tetanus germ to convert corn mash into acetone, Pfizer's process by which the mold *asperfillus niger* transforms ordinary sugar into citric acid, Fleming's discovery of the penicillin mold, Waksman's discovery of streptomycin, etc. A section shows the step-by-step production of antibiotics.

**Fortisan-36.** Technical Bulletin TD-20A describes the physical, chemical, and electrical properties of Fortisan-36, a regenerated cellulose (rayon). Processing information and seven pages of charts and graphs are included. *Celanese Corp. of America, Textile Div., Charlotte, N. C.*

**Evaporators.** Three types of evaporation equipment for plastics, chemical, food, petroleum, and drug process industries, operating over the range from volatile solutions to powder with varied control, are described in Bulletin 125. Operating principles, specifications, and product applications of the equipment are covered. *Process Equipment Div., Rodney Hunt Machine Co., Orange, Mass.*

**Packaging.** Six-page folder describes and illustrates a method of packaging irregularly shaped meat and dairy products. Four different ways to identify the packaged product and to place an advertising message on it are listed. *Amsco Packaging Machinery Leasing Corp., 31-31 48th Ave., Long Island City 1, N. Y.*

**Abrasive separators.** Bulletin 1003 describes four types of separators which handle from 33,000 to 320,000 lb./hr. of abrasive. Principles of operation and the types of equipment available are discussed. *Pangborn Corp., Hagerstown, Md.*

**Hydraulic presses.** Brochure describes hydraulic presses for molding, laminating, polishing, curing, and embossing; combination presses and presses for special uses are also covered. *The R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.*

**Protective clothing.** A 12-page catalog lists a line of protective clothing—gloves for handling abrasives, raincoats, suits, hats, and aprons. *B. F. Goodrich Co., Akron, Ohio.*

**Vinyl lacquers.** Technical bulletin describes the use of a product for flatting vinyl lacquers to give a low-gloss effect. Tests are reported in detail. *Davison Chemical Co., Sales Control Dept., Baltimore 3, Md.*

**Product bulletin.** The "Nopco News," first of a series of quarterly product bulletins, is devoted to new products developed for a specific market, but having widespread applicability to other industries. Included in the first issue are products for use in the plastics, insecticide, pulp and

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## BLACK PHENOLIC MOLDING COMPOUND

INDUR 105 is a black phenolic molding compound for general use. Because it is manufactured to strict quality standards, you can rely on INDUR 105 to produce pieces of unexcelled quality at a high production rate. *Our experienced technical staff is at your service!*

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paper, rubber, textile, detergent, and adhesive industries. *Nopco Chemical Co., Harrison, N. J.*

**Naphthalene.** A 12-page booklet, SD-58, part of a continuing series of safety data sheets, gives properties and information for the safe handling and use of naphthalene. Shipping containers, storage, waste disposal, and health hazards and their control are the main points discussed. 30¢. *Manufacturing Chemists' Association, 1625 Eye St., Northwest, Washington 6, D. C.*

**Non-metallics.** Bulletin K-51 describes a line of nylon, Teflon, and specialty non-metallics in terms of properties and characteristics. Stock shapes, standard size ranges, specific uses, and advantages are given. *Polymer Corp. of Pennsylvania, Reading, Pa.*

**Salesman story.** How the modern salesman works, what he does, and why, is portrayed in a 32-page booklet entitled "The Salesman Story." It illustrates the function performed by the nation's five million salesmen and the vast sales effort that employs, directly or indirectly, perhaps 15 million men and women. Numerous histories and examples of successful sales promotions are given. *E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.*

**Hydrogen peroxide.** Revised 20-page safety data booklet SD-53 gives properties and information for the safe handling and use of hydrogen peroxide, including shipping containers, storage, waste disposal, and health hazards and their control. 30¢. *Manufacturing Chemists' Association, 1625 Eye St., Northwest, Washington 6, D. C.*

**Synthetic thickener.** Suggested as replacements for natural thickeners in a broad range of industrial applications, seven polyelectrolytes are discussed in a 28-page booklet. Chemical and physical properties, the preparation of solutions, applications, solvent compatabilities, advantages, and suggested uses are described. In addition, 15 pages of graphs show how viscosities of various latices vary with the latex concentrations for a range of thickener concentrations. *Dept. SZ, Monsanto Chemical Co., Springfield, Mass.*

**Company history.** Booklet entitled "Quality Service" traces the history of a company producing fasteners. Location of the company, its policies, and services are described. *Southern Screw Co., P. O. Box 1360, Statesville, N. C.*

**Chlorine compounds.** A 48-page booklet, F-4769, discusses the applications of 18 products used in the manufacture of pharmaceuticals, adhesives, plasticizers, surfactants, lubricants, emulsion and foam breakers, resins, etc. A list of references is included. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

**Reinforced plastics.** Report PB 111721 describes parallel glass fiber structures developed for the reinforcement of plastics. Physical and chemical properties of the fibers and their relation with plastics are discussed. $1.50. *OTS, U. S. Dept. of Commerce, Washington 25, D. C.*

**Glass fibers.** Catalog WPD-11 describes and illustrates uses of blanket insulations for thermal and acoustical treatments, resilient cushion materials, quartz and glass micro-fibers, reinforcements for plastics, and yarns for the textile industries. *L.O.F. Glass Fibers Co., 1810 Madison Ave., Toledo 1, Ohio.*

**Birefringence.** Three methods of measuring the birefringence of hot-worked acrylics are described in report PB 111825. Equipment and procedures for the tests are outlined. Also included are experimental results of non-destructive tests on sheets of hot-worked materials. 75¢. *OTS, Dept. of Commerce, Washington 25, D. C.*

**Polyethylene.** Two information bulletins—X-70 and X-19B—deal with extrusion and injection molding of polyethylene, respectively. Both give information on equipment, shrinkage, etc. The bulletin on extrusion presents, in addition, drawings and schematics to illustrate such things as wire coating, extrusion coating, and blown film extrusion. *E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.*

**Curing systems.** Technical Bulletin 204 describes a coprecipitate of lignin and a butadiene-styrene copolymer for use as a reinforcing agent. Properties, advantages, and technical data are given. *Polychemicals Div., West Virginia Pulp and Paper Co., Charleston A, S. C.*

**Combustion unit.** Bulletin LEP-1 describes a high-frequency combustion unit for rapid determination of total sulfur in diesel fuel, kerosene, oil sludges, lubricating oils, lubricating oil additives, tars, asphalts, spent caustics, catalysts, and other inorganic materials. The method used is outlined and accessories are listed. *Laboratory Equipment Div., Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, Ill.*

**Styrene monomer.** The technique for storing and handling styrene monomer is summarized in a six-page technical bulletin. Construction materials, storage tanks, piping, pumps, valves, gaskets, filters, insulation, storage life, drum storage, and safety precautions are discussed. *Dept. SE, Monsanto Chemical Co., Springfield, Mass.*

**Polyphenyls.** Three chlorinated polyphenyls suited for the plasticizing of polyvinyl acetate emulsion adhesives are described in Technical Bulletin O-111. Properties, advantages, specifications, and laboratory data are included. *Monsanto Chemical Co., 800 N. Twelfth Blvd., St. Louis 1, Mo.*

**Polyvinyl chloride.** Bulletin 4B describes a line of polyvinyl chloride sheets, bar stock, pipe fittings, pipe, blocks, valves, etc. Chemical, physical, electrical, and thermal properties are listed. Dimensions and specifications are also given. *H. N. Hartwell & Son, Inc., Park Square Bldg., Boston, Mass.*

**Natural polymers.** Polymer solutions in dioxane and solid disks


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KILLER KANE and its companion piece SPRAYER KANE are fine examples of the complete and specialized service we can provide. They also show how durable, chemical resistant plastics are helping in the present day home owners' fight against weeds and insects.

The two assemblies comprise 39 individual parts of which 23 are plastic, molded and assembled to close tolerances. Final assembly and packaging is done on a high volume, mechanized basis.

By thus using the complete and well organized facilities of our modern plant, our customer greatly reduced his production and handling problems.

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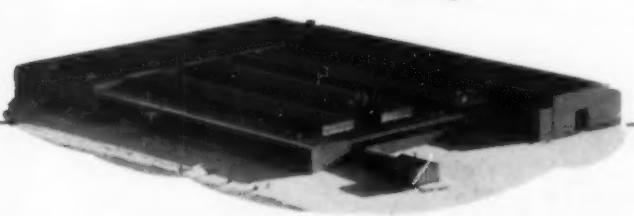

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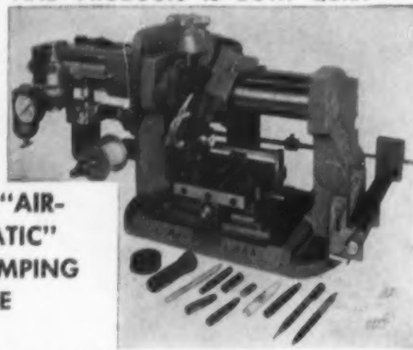
OF THERMOSETTING AND THERMOPLASTIC PARTS AND PRODUCTS IS BOTH QUIET AND EFFICIENT WHEN YOU USE THIS Model No. 9AA "AIR-AUTOMATIC" HOT STAMPING MACHINE



The ACROMARK No. 9AA Machine has compensating provisions for variations and it may be provided for fully or partially automatic operation. The ACROMARK "line-contact" principle of marking is fully utilized in this machine to insure perfect marking in any desired color at marking speeds up to 50 or more parts per minute depending upon the size and material.

SEND A SAMPLE OR SKETCH OF YOUR PRODUCTS—TODAY—FOR QUALIFIED ENGINEER'S RECOMMENDATION OF PROPER MARKING EQUIPMENT.

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COTTON FLOCK
**FILLERS**

# NO FAT!

BASICALLY, there are two types of finished plastics—*passive* and *active*. Passive plastics need little strength; they're light, thin-framed and primarily decorative. In them, the use of muscular fibres would be a waste of strength.

On the other hand, the compression molded thermosetting types lead *active* lives. They're constantly handled — ever on the go. They're threaded, tapped, undercut, multi-walled and recessed. Such shapes require super-strength — and an insured resistance against shock or breakage. For such parts and products, the stepped-up muscle building strength of Claremont Cotton Fillers becomes the strong heart of any specified plastic formulation . . . and qualifies it to serve extra high impact requirements. Write for samples.

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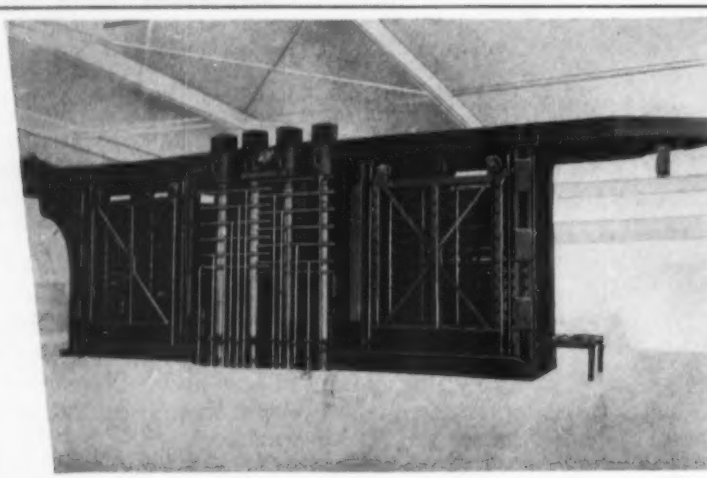
**CLAREMONT, NEW HAMPSHIRE**



Multi-opening laminating press with fully automatic loading and unloading equipment.

## Hydraulic Presses

**of all dimensions and pressure capacities**

**Our only specialty for more than thirty-five years**

**BECKER & VAN HÜLLEN,** KREFELD, WEST GERMANY

Sole U. S. representative: **KARLTON MACHINERY CORPORATION,**
**210 E. Ohio Street, Chicago 11, Illinois**

of the polymers containing varying amounts of plasticizers are described (with emphasis on dielectric behavior) in report PB 111857. $2.25. *OTS, U. S. Dept. of Commerce, Washington 25, D. C.*

**Polymethyl methacrylate.** Dynamic mechanical properties of polymethyl methacrylate over a frequency range of $6 \times 10^{-4}$ to $1.6 \times 102$ cycles/sec. and a temperature range of $-20$ to 80° C. are described in report PB 111642. $1.00. *OTS, U. S. Dept of Commerce, Washington 25, D. C.*

**Adhesives.** Chart lists technical data, form, percent solids, average viscosity, shortest cure time or lowest temperature to get best properties, and application suggestions for 30 adhesive formulations for bonding plastics and metals to themselves and to each other. *Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J.*

**Bagging scales.** Bulletin 8246A describes automatic bagging scales for duplex use, as a bulk unit, and as a dock-type scale for high-speed operation at portside. Accessory equipment and optional discharge systems are also covered. *Richardson Scale Co., Van Houten Ave., Clifton, N. J.*

**Testing machines.** Hydraulic machines with capacities from 10,000 to 5,000,000 lb., including standard and special types of vertical and horizontal machines, are described in Bulletin 4401. *Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.*

**Hydrogen peroxide.** Bulletin 70 describes the commercial development of hydrogen peroxide solutions in the concentration range between 90 and 100% $H_2O_2$ content, and presents a simplified description of the fractional crystallization process which makes this product possible. A table of physical data for $H_2O_2$ concentrations of 90, 95, and 100% is included, together with a discussion of stability, solubility, energy content, hazards, containers, engineering materials for handling, and analysis procedures. *Becco Chemical Div., Food Machinery and Chemi-*

(To page 210)

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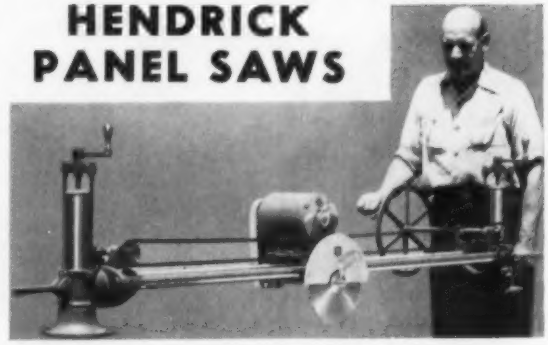
CUT and TRIM PLASTIC PLYWOOD METAL **PANELS**

with

## HENDRICK PANEL SAWS



Showing manually operated Model MLR-6 set for horizontal operation; can also be mounted vertically. Saw tilts to 90° for bevel cutting.

**This model $278.00 less motor.**

Now you can size sheet stock singly or in combination—accurately—easily—quickly—with very small investment. Satisfaction guaranteed. Fully automatic models available—motors ¾ to 3 H.P. Cutting capacity up to 12½ feet. Endorsed by leading plywood and plastic fabricators. Write TODAY for full information covering these sensational panel saws.

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**Marblehead, Mass.**

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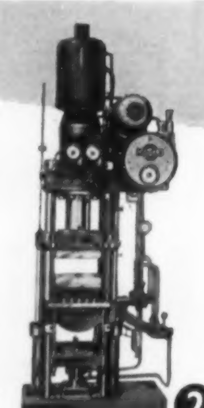
# DANIELS

1

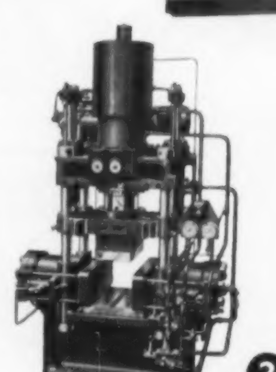


2

## MOULDING PLANT
## For Plastics & Rubber
## IN USE ALL OVER THE WORLD

Illustrated are three of Daniels' productions—approved by leading manufacturers at home and abroad. Very finely designed for easy and efficient working, they offer the most up-to-date methods of moulding Plastics & Rubber for innumerable uses.

1. TABLETTING MACHINE
2. COMPRESSION MOULDING PRESS with hydraulic ejection and time cycle control.
3. SIDE RAM PRESS



3

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# T. H. & J. DANIELS LTD.

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*cal Corp., Station B, Buffalo 7, N. Y.*

**Urethane.** Pamphlet entitled "Mobay and the Urethane Story" describes the company's plant layout, its products, and its facilities. A sample piece of urethane foam (seven different colored strips cemented together with isocyanate) is included. *Mobay Chemical Co., Geyer and S. 2nd Sts., St. Louis 4, Mo.*

**Technical papers.** A 347-page book presents all of the papers and panel discussions given at the 23rd annual convention of the A.S.T.E. in Los Angeles. Covered are 16 separate lectures, four panels, and an A.S.T.E. Research Fund report on workpiece temperature distribution. $5.00. *Collected Papers, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.*

**Mold bases.** Catalog lists complete line of mold bases, retainer sets and plates, ejector housings, core pins, counterbores, hand grinders, bristle polishing brushes, end mills, carbide cutters, etc. Information on mold design is also presented. *Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit, Mich.*

**Dielectric materials.** Publication No. PB111863, entitled "Proceedings of the Conference on Dielectric Materials," consists of papers on many aspects of radiation effects on organic and inorganic materials. Presented at the December 14, 1954, Conference sponsored by the Naval Research Laboratory and the Air Research and Development Command, papers included in the 169-page volume are: A survey of the Chemistry of Polymer Formation; Polymer Synthesis by Gamma Radiation; Radiation Effects on Glass; Radiation Stability of Polymers; and Conductivity of Polyethylene and Teflon During Irradiation at Low Temperatures. $4.25. *OTS, Dept. of Commerce, Washington 25, D. C.*

**Vinyl chloride.** Booklet CA.068 describes a line of polyvinyl chloride polymers and copolymers for extrusion, calendering, spread-

coating, injection molding, dip-coating, etc. The line includes four groups: Series 100, polymers manufactured by the emulsion process; Series 200, polymers manufactured by the suspension process; Series 300, paste-making polymers (plastisols, organosols, etc.); and Series 500, vinyl chloride-vinyl acetate copolymers. Characteristics, properties, and suggested uses are given for every formulation in each series. *Solvic S.A., 33, rue Prince Albert, Bruxelles, Belgium.*

**Vinyl foam.** Booklet describes the characteristics and uses of a vinyl foam in the fields of transportation seating, automotive fixtures, apparel, and household accessories. *Elastomer Chemical Corp., 212 Wright St., Newark 5, N. J.*

**Trouble shooting.** Guide lists 16 "troubles" that may occur in the molding of polystyrene, covering likely faults and possible remedies. *Kleestron Ltd., West Halkin House, West Halkin St., London, S.W. 1, England.*

**Plastics fabricator.** A 20-page booklet tells how a company grew into a diversified plastics research engineering and fabricating firm. Typical products, how they are made, the variety of plastics materials used in their manufacture, etc., are covered. *Luria-Cournand, Inc., Havre de Grace, Md.*

**Plastic pipe.** Plastic pipe is analyzed and evaluated in a technical and market study entitled "Pipelines to the Future." Charts and tables compare the performance and cost of the important plastics and metal pipe materials, and list the advantages and limitations of the major plastic types. *$1.00. Monsanto Chemical Co., Springfield 2, Mass.*

**Correction**

We have been informed by The Emeloid Co., Inc., that the Conceptulator described on page 233 of the March issue of MODERN PLASTICS is fabricated by that company for Davidson Associates, New York, N. Y., and not for Fielding Associates, as stated in the article.

# Plastics

Production and sales figures in pounds* for November and December 1955

| *Materials* | *Total p'd'n first 12 mos. 1955* | *Total sales first 12 mos. 1955* |
|---|---|---|
| *Cellulose plastics:*[a] | | |
| Cellulose acetate, mixed ester | | |
| Sheet, under 0.003 gage | 18,800,839 | 18,917,536 |
| Sheets, 0.003 gage and over | 15,854,838 | 15,073,069 |
| All other sheets, rods, tubes | 7,646,174 | 7,226,855 |
| Molding, extrusion materials | 91,716,464 | 90,120,865 |
| Nitrocellulose sheets, rods, tubes | 4,868,874 | 5,100,383 |
| Other cellulose plastics | 5,868,788 | 5,430,672 |
| *Phenolic and other tar-acid resins:* | | |
| Molding materials[a] | 211,486,559 | 195,529,591 |
| Bonding and adhesive resins for: | | |
| Laminating (except plywood) | 65,460,541 | 50,883,109 |
| Coated and bonded abrasives | 41,802,979 | 32,892,734 |
| Friction materials (brake linings, clutch facings, etc.) | 25,658,273 | 22,783,260 |
| Thermal insulation | 51,902,346 | 51,842,437 |
| Plywood | 41,076,450 | 33,512,118 |
| All other bonding uses | 24,403,523 | 23,893,577 |
| Protective-coating resins | 26,446,116 | 24,859,909 |
| Resins for all other uses | 36,683,795 | 32,150,331 |
| *Urea and melamine resins:* | | |
| Textile-treating resins | 42,202,277 | 41,133,524 |
| Paper-treating resins | 22,799,145 | 21,580,786 |
| Bonding and adhesive resins for: | | |
| Plywood | 97,760,888 | 92,119,167 |
| All other bonding and adhesive uses, including laminating | 28,064,547 | 27,617,997 |
| Protective-coating resins | 38,410,276 | 29,668,373 |
| Resins for all other uses, including molding | 83,792,959 | 80,057,749 |
| *Styrene resins:* | | |
| Molding materials[a] | 420,937,096 | 380,809,717 |
| Protective-coating resins | 101,155,262 | 92,636,515 |
| Resins for all other uses | 94,475,972 | 84,590,873 |
| *Vinyl resins,* total[b] | 698,083,413 | 658,806,262 |
| Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for: | | |
| Film (resin content) | | 83,277,823 |
| Sheeting (resin content) | | 51,423,443 |
| Molding and extrusion (resin content) | | 183,736,804 |
| Textile and paper treating and coating (resin content)[c] | | 65,209,544 |
| Flooring (resin content) | | 56,356,346 |
| Protective coatings (resin content) | | 27,439,255 |
| All other uses (resin content) | | 54,904,898 |
| All other vinyl resins for: | | |
| Adhesives (resin content) | | 31,808,136 |
| All other uses (resin content) | | 108,650,012 |
| *Coumarone-indene and petroleum polymer resin:* | 259,632,091 | 257,714,861 |
| *Polyester resins:* | | |
| For reinforced plastics | 51,296,719 | 43,919,319 |
| For all other uses | 3,533,467 | 3,178,547 |
| *Polyethylene resins:* | | |
| *Miscellaneous:* | | |
| Molding materials[a, d] | 135,905,968 | 105,884,731 |
| Protective-coating resins[e] | 4,318,788 | 2,662,320 |
| Resins for all other uses[f] | 97,350,758 | 95,874,774 |

* Dry basis designated unless otherwise specified.
** Partially estimated. † Revised.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c] Includes

# Production

From statistics compiled by the U. S. Tariff Commission

| November** | | December** | |
|---|---|---|---|
| *Production* | *Sales* | *Production* | *Sales* |
| 1,374,123 | 1,673,413 | 1,756,841 | 1,534,076 |
| 1,511,326 | 1,428,203 | 1,687,507 | 1,330,335 |
| 609,915 | 648,746 | 596,242 | 595,081 |
| 8,394,060 | 8,730,489 | 7,704,943 | 7,509,299 |
| 451,304 | 484,404 | 427,691 | 463,960 |
| 642,969 | 616,466 | 432,564 | 392,715 |
| †19,127,373 | 17,979,534 | 18,766,381 | 16,121,640 |
| †6,140,152 | 4,708,612 | 5,989,404 | 4,099,529 |
| 1,364,209 | 1,547,468 | 1,480,977 | 1,468,008 |
| 2,211,229 | 1,978,137 | 2,254,040 | 1,682,532 |
| 5,124,975 | 5,308,691 | 5,286,628 | 4,903,227 |
| 3,992,141 | 3,242,251 | 3,960,805 | 3,286,398 |
| 3,033,871 | 3,021,443 | 2,493,996 | 2,384,381 |
| 2,492,856 | 2,187,316 | 2,127,490 | 1,902,686 |
| 3,670,563 | 2,893,882 | 2,811,800 | 2,349,072 |
| 4,049,269 | 3,975,455 | 3,909,147 | 3,989,724 |
| 2,067,965 | 1,618,217 | 2,006,878 | 1,944,964 |
| 8,651,944 | 8,090,290 | 8,576,901 | 7,475,691 |
| 2,417,609 | 2,365,180 | 2,056,502 | 2,092,808 |
| 3,522,960 | 2,837,003 | 3,150,606 | 2,241,817 |
| 8,010,403 | 7,444,906 | 7,656,699 | 6,050,775 |
| 40,081,328 | 36,256,231 | 39,427,912 | 30,306,203 |
| 9,288,551 | 7,951,862 | 9,147,569 | 7,797,510 |
| 8,190,607 | 8,096,569 | 8,005,788 | 7,314,099 |
| 62,199,548 | 62,806,065 | 61,285,034 | 57,558,148 |
| | 6,855,426 | | 6,273,264 |
| | 4,771,308 | | 4,584,814 |
| | 18,223,569 | | 16,682,241 |
| | 6,271,048 | | 6,088,687 |
| | 4,944,752 | | 4,214,077 |
| | 2,146,625 | | 1,979,948 |
| | 6,817,738 | | 5,457,546 |
| | 2,944,785 | | 2,190,142 |
| | 9,830,814 | | 10,087,429 |
| 23,211,850 | 22,835,355 | 19,891,828 | 19,192,119 |
| 4,080,086 | 3,963,140 | 5,152,630 | 4,075,703 |
| 361,717 | 397,204 | 399,722 | 197,212 |
| 40,911,329 | 35,630,762 | 40,609,609 | 34,448,193 |
| 4,928,198 | 4,449,268 | 4,762,741 | 3,858,790 |
| 341,261 | 215,656 | 262,911 | 234,343 |
| 7,635,285 | 7,355,858 | 7,322,356 | 7,173,803 |

data for spreader and calendering-type resins. [d] Includes data for acrylic, polyethylene, nylon, and other molding materials. [e] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins. [f] Includes data for acrylic resin modifications, nylon, silicone, polyethylene, and other plastics and resins for miscellaneous uses.

## Concentration of shear at the bonded edge of a fiber under tension*

*By J. O. Outwater, Jr.*†

Consider the case of a fiber of diameter $D$ bonded by adhesive along a length $L$ with a maximum tension $T_M$ in the fiber and with a tension $T_O$ at the edge of the bonded length of fiber where it begins to slip relative to resin.

Let the tension in the fiber be $T$ at a distance $y$ from the point where the strain in the fiber is the same as the strain in the composite material, and $S$ be the shear strain in the resin tube of thickness $t/2$ surrounding the fiber. Then, if we assume that the tension in the fiber is uniform across its section:

$$-dT \cdot \frac{\pi D^2}{4} = S \cdot \pi \cdot D \cdot dy$$

$$\text{or } S = -\frac{dT}{dy} \cdot \frac{D}{4}$$

$$\text{But } S = \frac{G}{\frac{t}{2}} \int_0^y \frac{T_M - T}{E_O}\, dy$$

where $G$ is the shear modulus of the resin;

$$\text{so } \frac{dS}{dy} = \frac{2G}{t} \cdot \frac{T_M - T}{E_O}$$

$$\text{or } \frac{d^2T}{dy^2} = \alpha^2 (T - T_M)$$

$$\text{where } \alpha^2 = \frac{8G}{t \cdot E_O \cdot D}$$

$$\text{or } T = T_M - (T_M - T_O) \frac{\sin H \alpha y}{\sin H \alpha L}$$

$$\text{and } S \frac{D}{4} \cdot \alpha (T_M - T_O) \frac{\cos H \alpha y}{\sin H \alpha L}$$

When the maximum shear

$$S_{MAX} = (T_M - T_O) \sqrt{\frac{G}{E_O} \cdot \frac{D}{2t}} \cot H \alpha L$$

and substituting reasonable values for G, $E_O$, and D/2t, we get:

$$S_{MAX} = \frac{1}{2} (T_M - T_O) \cot H \alpha L$$

$$\text{But } \alpha L = \sqrt{\frac{8G}{E_O} \cdot \frac{D}{t} \cdot \left(\frac{L}{D}\right)^2}$$

$$\simeq 2 \frac{L}{D}$$

$$\text{So if } \frac{L}{D} > 1, \text{ then } \cot H \alpha L \simeq 1$$

$$\text{and } S_{MAX} \simeq \frac{1}{2} (T_M - T_O)$$

But as $T_M$ is the ultimate tensile strength of the glass fiber, and $S_{MAX}$ is the ultimate adhesive shear between the glass and the resin and, therefore, very much smaller than $T_M$, it can be seen that $T_O$ can only be slightly less than $T_M$ to satisfy this equation.

This implies then that the actual linear distance along the fiber where the adhesive remains in shear and bonded to the fiber is very small indeed compared to the length of fiber where the resin has moved relative to the fiber. Hence, we can assume that the shear line will travel substantially all the way up to the point where the strain in the fiber will be the same as that in the composite material.

*Addendum to article in MODERN PLASTICS 33, 156 (March 1956).
†Industrial Liaison Office, Massachusetts Institute of Technology.

## Styrene foam float and life preserver ring

**N**on-sinkable, non-corroding floats and life preserver rings, with flotation elements of styrene foam, provide safety and fun for the entire family.

The manufacturer states that it has attempted to use plastics wherever possible in the construction of both products in order to obtain a completely corrosion-free, maintenance-free product which will last for many years without deterioration. The few metal parts on both items are aluminum or brass. Both the float and the ring are covered with a coating of polyvinyl chloride, noted for its chemical resistance and long life.

The float, which is actually a lightweight raft, is constructed of foamed styrene that does not absorb water, supported by an aluminum tubing frame. Measuring 4 by 7 ft. long and only 4 in. thick, it can support 750 lb. (equal to four adults or several children), though it weighs only 46 pounds.

As a result of its unusual bottom design, the raft will not tip or skid away when diving from it, and a 3½-lb. anchor will prevent it from drifting even in rough water. In addition, there is no painting problem; it is covered with attractive plaid saran.

The float is also available with folding 12-in. legs for easy conversion into a beach table.

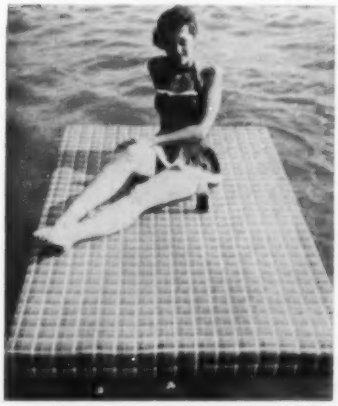
The regulation 20-in. life preserver ring, approved by the U.S. Coast Guard, is molded of expandable styrene beads. However, because the ring is covered with fibrous glass-reinforced polyester resin, it is claimed to be absolutely resistant to rot, deterioration, or any ordinary type of corrosive action.

All the straps and flaps, which make up the compartments to hold two lines, flare guns, dye markers, and shark repellent in the ring, are synthetically treated fabrics, and the ring itself is surrounded by a nylon grab-rope. Rings, snaps, and all metal parts are made of brass.

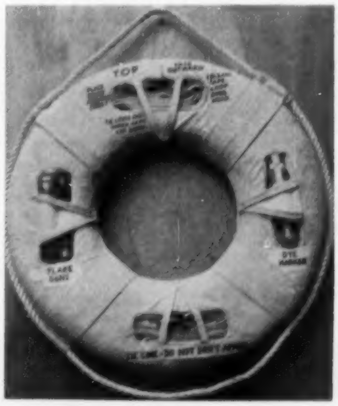
To use the ring, the top line is removed by unsnapping the flap, putting the wearer's head through a loop provided, and tying the straps from behind across the ring to secure it to the chest.

A 30-in. approved ring for commercial vessels will be available in the near future.

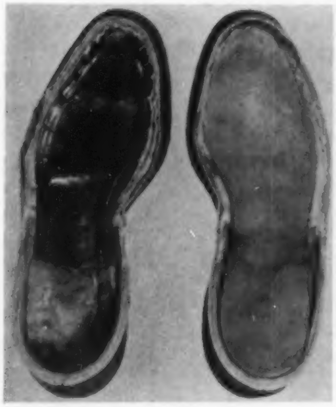
*Credits:* Both the float and the ring are manufactured by Surface Coating Engineers, Inc., Kalamazoo, Mich. "Rescue-ring" is molded of Dylite expandable styrene supplied by Koppers Co., Inc., Pittsburgh, Pa.; polyester resin supplied by The Glidden Co., Cleveland, Ohio; fibrous glass cloth supplied by Hess Goldsmith & Co., Inc., New York, N. Y. "Fun-float" is fabricated of Dow Chemical Co.'s Styrofoam; saran covering is Lumite produced by Chicopee Mills, Inc., New York, N. Y. Polyvinyl chloride coating material is produced by Surface Coating Engineers.



**Styrene** float is covered with attractive plaid saran



**Preserver** ring has flares, tie-line, and dye marker



**Cutaway** of shoes shows results of seven months' wear on ordinary (left), and vinyl insoles (right)

## Vinyl insoles

Longer wear, more even tread, and greater comfort result from the use of new shoe insoles made of vinyl resins. Rich in pores for breathing and absorbing perspiration without cracking, the vinyl insoles help to keep shoes in shape, dry, and comfortable. Since vinyl is resistant to perspiration, water, mould growth, and most chemicals, it was the natural choice for the application.

To make the soles, a layer of porous vinyl, produced by an undisclosed method developed by the manufacturer of the insoles, is laminated between two layers of latex-impregnated backing. This sandwich is then split to form two insoles, for left and right shoes. The porous surface is uppermost for contact with the foot.

To test the new insole, a machine operator wore one in his right shoe, and an ordinary insole in his left shoe, for seven months. Absorbed moisture, brittleness, hardening, and shrinking caused the conventional insole to crack and lose its flexibility, while the new porous insole remained soft, resilient, and unbroken after the seven months' trial. Similar tests showed that the shoes having porous insoles hold their appearance and shape better and have less tendency to curl up at the toe.

*Credits:* Poron insoles are produced by United Shoe Machinery Corp., Boston, Mass., using Bakelite vinyl.

## Phenolic heater grille

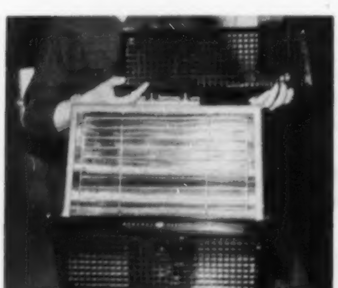
Improved safety features and light weight were the main considerations which resulted in the selection of wood flour-filled phenolic moldings rather than zinc die castings for the housing grille of the blower fan in a new automatic space heater. In the photograph below, one of the new grilles is shown in position on the front of the heater; another grille, held above the heater, gives a rear view of the large molded piece.

The weight and cost of the zinc die-castings previously used for such jobs were found to be excessive. With the new phenolic grille, the portable heater can be moved from place to place with a minimum of effort; of the 13 lb. total weight of the assembled heater, only 1½ lb. are represented by the grille. The grille not only acts as a guard for the fan's mechanism but also prevents accidents which might be caused by small children through tampering with the fan's rotating blades.

The grille has molded-in holes to facilitate assembly which is accomplished with four screws, one in each of the corners. Color is also molded-in, thus eliminating need for subsequent painting operations.

The phenolic material is resistant to heat, will not conduct electricity, and can stand up very well under the abuse to which this type of product is normally subjected.

Credits: Grille is molded by General Electric Co.'s Plastics Dept., using G.E. wood flour-filled phenolic, for the General Electric Fan Dept., Bridgeport, Conn.



**Lightweight** grille for heater is molded of phenolic

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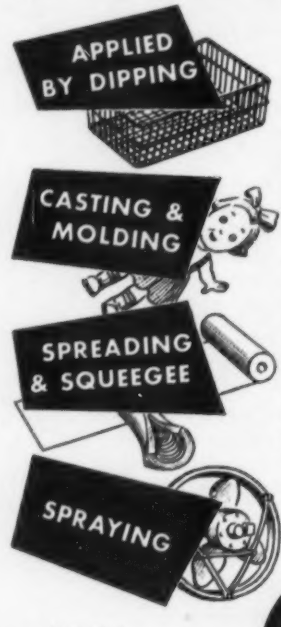
## PLASTISOLS and ORGANOSOLS

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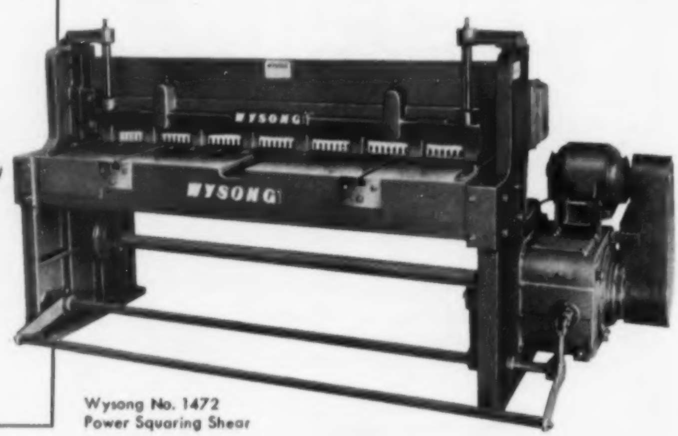


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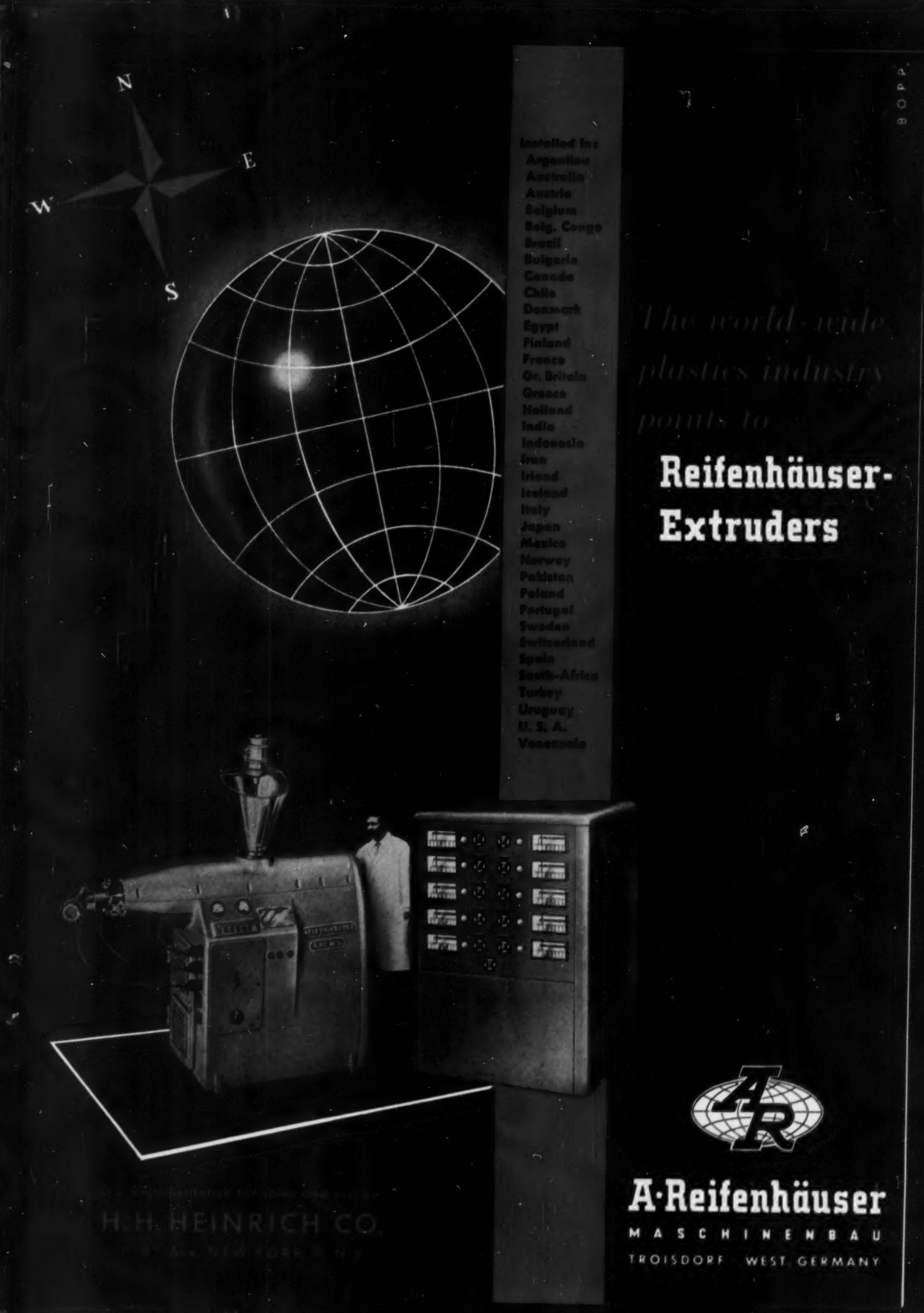
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Greece
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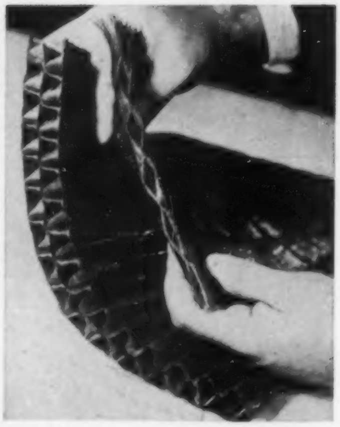


**Polyethylene** yarn in fabric (upper right) shrinks in boiling water to three-dimensional shape (left)

## Fabrics with depth

**A** new dimension—depth—has been added to textiles by taking advantage of the hitherto undesirable property of shrinkage. In the radical departure from conventional methods of textile manufacture, prestretched polyethylene yarn is used to produce a new type of depth in fabrics.

The simple but effective technique makes use of the "memory of polyethylene monofilament yarn." The yarn is first prestretched and then woven with conventional textile fibers on a regular loom. By simply immersing the completed fabric in boiling water for a few seconds, the polyethylene, which runs lengthwise in the material, will shrink to its original length—as much as 55%—pulling the other fibers to form a permanent three-dimensional fabric.

According to William E. Clark, vice president and general manager of U.S. Rubber Co.'s Textile Div., which is producing the new fabric, first use will be in automotive and furniture upholstery, where the cushioning effect of the fabric's three-dimensional structure offers unusual comfort and free circulation of air between the person and the seat. It is also claimed that the fabric has the advantage of not being totally compressible under a person's weight and will not collapse under long periods of compression.

## Reinforced plastics school desks

Commercially produced classroom furniture with seat-backs and desk tops made of fibrous glass-reinforced polyester resins are now being used to replace traditional furniture made of wood. On the basis of the reception accorded the first 3000 units, the designer predicts that the new material's durability, color range, economical maintenance, and seating comfort will result in widespread school use of the furniture throughout the country.

In one unit style, the reinforced-plastics desk tops and seat-backs are mounted on movable pedestal understructures in which, by separate adjustments, the seat can be moved upward or downward and the desk upward and outward to fit the pupil. In another style, they are mounted on tubular steel to provide separate chair and table units.

Available in green, gray, buff, pink, brown, and black, the production of these polyester resin desk tops and seat-backs is said to be the result of several years of research in which a material was sought which would solve many of the problems presented by excessive light reflection, demand for color, high maintenance costs, and pupil fatigue. Fibrous glass reinforced-polyester resin moldings, bonded to aluminum frames with epoxy adhesives, provided the answer.

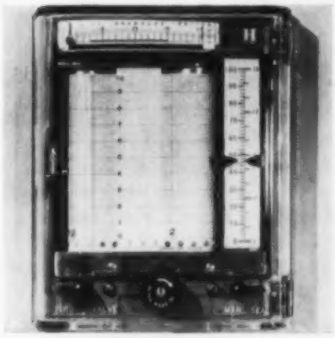
The materials provide a resiliency not obtainable in wood or with steel supports; this factor, plus the translucency obtained through proper use of color and pigment to gain low light reflection, combine with the basic designs of the units to contribute materially to reduction of pupil fatigue. Since the color is molded into the material, refinishing is not necessary, and the tough, scratch-resistant surface can be cleaned with water and mild abrasives without damage.

The desk tops and seat-backs are molded of standard polyester resins, with fillers and fibrous glass roving, by the preform technique. In addition to the single-unit desk and chair combination, a number of separate table and chair unit adaptations have been developed. In one of these, molded reinforced-plastics parts are used to produce a hinged top for a book box desk.

*Credits:* School-room furniture designed by William J. Bargen is molded by Structurlite Plastics Corp., Hebron, Ohio, using fibrous glass supplied by Owens-Corning Fiberglas Corp., Toledo 1, Ohio, and polyester resins supplied by Barrett Div., The Allied Chem. & Dye Corp., New York, N.Y. and Pittsburgh Plate Glass Co., Pittsburgh, Pa. Assembly and distribution by General School Equipment Co., St. Paul 4, Minn.

**Desk** and chair combination aids in reduction of fatigue

**Reinforced** plastics are used in hinged top for book box desk



**Acrylic** door protects instrument, affords visibility

## Instrument door

**R**equirements for a small transparent door for a recording instrument demanded a material which can withstand impact, has resistance to petroleum and other common chemicals, has optical clarity, and can be molded to precise dimensions. For this combination, the manufacturer turned to acrylic.

The instrument for which the acrylic door was designed combines control and recording functions and is used in modern graphic panels where a complete diagram of the process is drawn on the panel board and instruments are inserted at points corresponding to points of measurement. Such variables as temperature, pressure, flow, or liquid level, are among those recorded.

The acrylic part, which measures 4⅞ by 5¾ by ⅞ in., is injection molded in single-cavity molds. Design of the mold is straightforward; however, a long cycle is used to control any shrinkage which might interfere with registration of hinge seats or with accuracy of engagement with the steel spring latch.

The acrylic piece provides an effective dust seal as well as a protective door through which readings can be taken. Weighing only 4½ oz. it permits the use of unobstrusive hinges only $^{11}/_{16}$ in. long.

*Credits:* Plexiglas acrylic supplied by Rohm and Haas Co., Philadelphia, Pa., is molded by Boonton Molding Co., Boonton, N. J., for Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

## Success in accessories

*(From pp. 99-106)*

quantity. Haldie Nicholson is turning the heels out in a six-cavity mold using equipment especially designed for thick-section molding.

Gabriel-Century Wood Heel Co., Brooklyn, N. Y., one of the pioneers in the field, produces the heels both by machining and injection molding. Since most of the heels in this company's line are high-style, hand-carved products in the $15 to $25 price range, runs of any one style are relatively limited. The majority of heels are therefore machined from rod stock.

For the more staple styles in the line, however, Gabriel-Century has developed a combination plastic-wood heel. The tapering bottom half of the heel, where the greatest strength is required, is injection molded in a standard shape; acetate and butyrate, as well as acrylic, are used. The wood top half is then machine-turned to set the desired style and the two parts are assembled by a molded-in dowel at the top of the plastic half which is simply coated with adhesive and pressed into a hole machined in the wood part.

### Assembly and decoration

Acrylic heels are mounted on the shoe with wood screws; acetate and butyrate heels can be nailed into place. Similarly, the wooden lifts which withstand the abrasion of walking contact are screwed to the acrylic and nailed to either the acetate or butyrate heels.

Assembly of transparent acrylic heels to the shoe raised a difficult design problem, inasmuch as the screws would be plainly visible through the heel. Some manufacturers hand-carve attractive floral patterns at the top and bottom of the heel to hide the screws. Another technique is to embed metallic flakes or sparkles in the heel. Still another is to cement a sheet of metallized polyester film to the top surface of the heel with the metallic side facing down into the heel. Reflection of light from the metallized film not only adds sparkle to the shoe, but effectively camouflages the screws.

In the area of more exclusive high-styling, a decorating technique has been devised by G.M.C. Process Corp., New York, N. Y., that permits electroplating of silver or gold on transparent acrylic heels as well as on colored acrylic, acetate, and butyrate heels. When plating wood, it is necessary to first deposit a heavy layer of copper before the silver or gold can be laid on. With plastic, however, the G.M.C. method permits sterling silver or gold to be applied, even in intricate filigree designs, directly to the heel without the necessity for any intermediate steps (photo, p. 104).

### Other plastic shoe parts

In women's dress shoes, there is a definite trend towards the use of vinyl for the front uppers. Again this year, it has been transparent vinyl sheeting, press-polished to a glossy finish and decorated with various ornaments, that has captured most of the market. Several manufacturers are also beginning to emphasize printed and embossed vinyls. Chelsea Mills, Inc., for example, makes available a clear vinyl sheet which is successfully embossed to simulate venetian glass, cracked glass, or cut crystal patterns.

In the field of scuffs and sandals, heat-sealed printed and embossed vinyl sheeting also plays a major role. As the padding material which cushions the shoes, both vinyl and polyurethane foam have recently come into the picture. House Products Corp., New York, N. Y., for example, distributes a line of sandals in which polyurethane foam is heat-sealed between two sheets of vinyl. According to Presto Mfg. Co., which fabricates the foam for the job, polyurethane foam in thicknesses of only 3/32 in. or 1/16 in. provides sufficient cushioning for an open vamp (photo, p. 102).

### Men's shoes

Even the conservative men's shoe industry is becoming a good market for plastics. Extruded

vinyl welting (the band that runs around the periphery of the shoe right above the sole) is currently in vogue in men's dress, casual, and work shoes. According to Dewey and Almy Chemical Co., Div. of W. R. Grace & Co., Cambridge, Mass., which supplies the welting, it was used in approximately 40 million pairs of shoes in 1955.

Dewey and Almy further reports that styling was just as instrumental in selling the vinyl welting as were its obvious physical advantages (the welting does not crack with age, it is completely water resistant, it holds color indefinitely, and it is easily wiped clean of mud or shoe polish). Designers have found that the colorful accents possible with the welting (available either in a single color or bi-colored) have tremendous merchandising appeal. Since the welting is extruded, the dies can be changed to produce an infinite variety of profiles and styles. Shoe manufacturers can apply these varied welt styles to come up with a number of different models all of which are made from a single last (photo, p. 105).

**Costume jewelry**

Plastics used in the costume jewelry field include acetate, acrylic, melamine, urea, styrene, and polyethylene.

Acetate's major application, of course, is in "pearl" beads, which are actually translucent spheres of alabaster cellulose acetate coated with a pearl-essence lacquer. Extruded acrylic rod, cut to length and centerless-ground into beads, is used for similar applications. The extruded material may be pearlescent, or the ground spheres may be dipped into a "pearl" lacquer.

Melamine and urea are used primarily in molding imitation "stones" for women's costume jewelry as well as for cuff links and tie pins. According to Greene Plastics Corp., Wakefield, R. I., a melamine-urea blend is a natural for the application. The compression molded stones have a permanent high lustre, they are scratch resistant, and they have a high degree of resistance to heat and many chemicals. These latter two characteristics are especially important inasmuch as they allow close soldering and electroplating of pieces with preset stones. In many instances, heat resistance is high enough to allow small metal castings to be poured directly around the molded pieces. By varying the formulation, various mottled effects can be obtained. Riverside Molding Co., Providence, R. I., another molder specializing in plastic jewelry, reports that the greater the percentage of melamine in the formulation, the glossier the stone. Tiny metallic flakes can be molded directly into the "stones" to provide glitter (photo, p. 106).

Greene Plastics Corp. also reports that where the relatively high tooling cost for compression molding is not warranted or where special properties such as flexibility are required, thermoplastic materials are used in costume jewelry. The most popular of these has been styrene. Lately,

however, there has been an increasing demand for polyethylene which provides the toughness and flexibility needed for modern high-speed assembly methods. The fact that polyethylene jewelry cannot break and the many interesting colors and textures in which it is available also contribute to sales appeal. To handle the thermoplastics, Greene has set up a battery of injection molding machines which are specially modified for using small and inexpensive molds.

Newest entry to the field of plastics costume jewelry are the polyethylene stringless beads introduced last year by Joseph H. Meyer Bros., Brooklyn, N. Y., as part of their famous Richelieu line. Each individual bead is molded with a peg and a socket on opposite ends of a diameter. Thus the beads can easily be snapped together to form a necklace or bracelet of any desired length. The peg is molded with a bulge around its middle which pops under the thin flexible rim of the socket (photo, p. 106).

The beads, in three different sizes, are precision molded in 60-, 80-, and 100-cavity molds. The company estimates that it is currently using about 40,000 lb. of polyethylene a month for the application. After molding, the beads are dipped into or sprayed with a pearl-essence lacquer. More recently, the company has been selling the beads without the pearl coating; consumer acceptance of the texture, glossy coloring, and pleasant feel of the polyethylene has been good. The polyethylene beads sell in the $1, $2, and $3 price range.

### New markets for plastics

The acceptance of plastics as staple materials in the fashion accessories field may well be highly important to other large-volume markets. Modern merchandising practices are such that styles, colors, and decorative concepts that start in the high-style fashion field seep down into the medium-price level of goods and eventually to the so-called mass market for consumer goods of all types. At the same time, they spread out into other and often seemingly unrelated areas. Thus, already one manufacturer who supplies a specially embossed and decorated vinyl sheeting to the handbag industry reports that automobile manufacturers have expressed interest in the possibilities of adapting the material to automobile interior decoration.

With plastics now well entrenched in fashion accessories, where they will be seen and admired for their decorative as well as their utilitarian features, other markets are likely to adopt this hard-to-beat combination.


*Credits:* Thanks to the following materials suppliers: American Cyanamid Co., New York, N. Y.; Bakelite Co., New York, N. Y.; Celanese Corp. of America, New York, N. Y.; E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.; Eastman Chemical Products, Inc., Kingsport, Tenn.; Firestone Plastics Co., Pottstown, Pa.; Hercules Powder Co., Inc., Wilmington, Del.; Monsanto Chemical Co., Springfield, Mass.; Rohm & Haas Co., Philadelphia, Pa.

## Automotive plastics

*(From pp. 114-118)*

a pronounced tendency to confuse the motorist.

The group of photographs on p. 115, showing typical tail-light assemblies as used on some of the 1956 automobiles, emphasizes several important points. It shows, for example, how many manufacturers are depending heavily upon distinctive tail-light design to permit immediate identification of the car from the rear. It has been said, and with considerable truth, that today's cars are easier to identify from the back than the front. These photos also point up the industry-wide trend to styling of integrated tail-light and back-up light assemblies. For example, Chrysler's new "forward look" derives much of its impact from distinctively designed tail-lights which conform to the basic styling theme. This treatment is well illustrated by the 1956 Plymouth, where the high, tapering tail-light and hooded back-up light assembly, closely integrated into the upswept rear fenders, gives a jet aircraft effect. In the 1956 De Sotos, the all-new rear-end treatment includes a turreted, three-tiered assembly made up of three separate molded acrylic lenses mounted one above the other, as in a traffic signal, with the white back-up light centered between the tail-light and the stop light.

### Unchallenged material

Molded acrylic, because of its excellent balance of properties, stands today unchallenged as the material for tail-lights and all other types of exterior lenses except for the sealed beam headlight. In addition, molded acrylic continues to dominate such other automotive components as decorative hood and rear deck emblems, in which the "second surface" coloring technique is universally employed, and instrument panel crystals, some of which are of considerable size and involve considerable quantities of material.

In its new 1956 models, Packard has introduced several interesting innovations involving parking and other lights with molded acrylic lenses. Wraparound style parking lights may be seen equally well from the front and side of the car. Another Packard innovation is a dual courtesy and safety light, located just behind the rear door, which not only guides entry and exit but also identifies the car in night driving and parking.

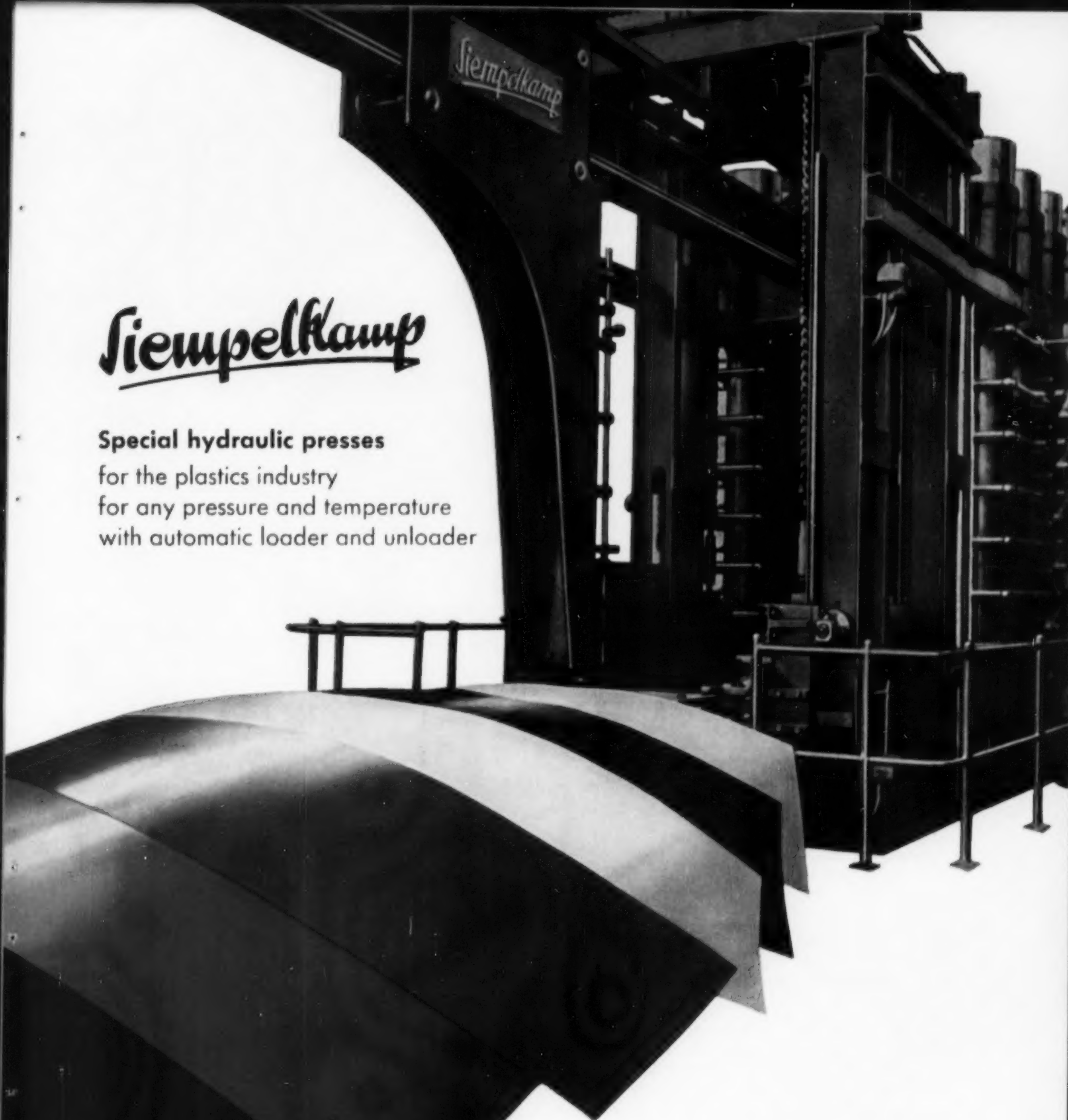
## Nylon

Molded nylon is continuing to strengthen its position as a new and versatile engineering material in the automotive field. Its toughness, light weight, high heat resistance, chemical resistance, and self-lubricating characteristics, along with its ability to be injection molded in intricate shapes, have led to its adoption for a wide range of components from speedometer gears to dome-light lenses.

As pointed out by John D. Young, Polychemicals Dept., E. I. du Pont de Nemours & Co., Inc., before the Golden Anniversary West Coast Meeting of the S.A.E., almost all of the commercial automotive uses of nylon have required that tolerances be widened to permit injection molding, since these parts cannot be held to the close tolerances applicable to machined metal parts. However, the nylon parts, because of the resiliency of the material, perform satisfactorily with the increased tolerances. In many cases, nylon affords economic advantages over other materials because of rapid mass production by injection molding, extremely light weight (which means more parts per pound), and superior performance.

A continuing use of molded nylon found in most of the 1956 cars is in door lock wedges, which receive a sharp impact each time the door is closed. With the door closed, nylon's resiliency provides vibration damping in the door and lock assembly; another advantage of nylon is that parts made of it require no lubrication which might soil passengers' clothing.

In many two-door models, where the front seats are hinged to permit access to the rear seat, molded nylon front-seat back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stops are employed. The material is so tough that the part will withstand the loads imposed by even the heaviest occupant of the seat.

### Dome lights

Molded nylon dome lights and other interior light lenses have become generally adopted by the industry because of their heat resistance, toughness, and other properties. In some instances, such lenses are molded with sections as thin as 0.025 inch. However, despite their thinness and light weight, these parts easily withstand rough treatment in assembly as well as service, while their non-shattering properties are an important safety factor.

Window crank-handle bearing plates, window regulator rollers, sleeve-type bushings for door lock push buttons, and brake pedal bushings are among the numerous molded nylon automotive parts in which toughness and bearing properties are being put to good use.

Nylon also answered one manufacturer's problem involving clutch cross-shaft bearings. All materials previously tested for this application were noisy, had to be oiled, and wore rapidly because of electrolytic corrosion. A molded nylon bearing filled the bill because it could operate without lubrication, it would not corrode, it eliminated the noise problem, and it provided improved clutch performance because of abrasion resistance and unique bearing characteristics.

Evaluated in competition with many other materials, molded nylon was found to offer the best combination of properties for a slotted bearing plate used on a new dash panel automatic transmission selector. The requirement called for a material which would prevent the selector lever from striking the metallic sides of the slot and would have low friction to prevent sticking. In addition, the part was required to eliminate squeaking without lubrication, while translucence was desired to permit transmission of light to illuminate the guide letters on the face of the plate. Under tests, one such molded nylon part was subjected to a million cycles without appreciable wear.

### Electrical parts

More and more molded nylon is showing up in automotive electrical parts. Breakage during winding is almost unknown with nylon coil forms, whereas with some materials this form of breakage can be a serious cost item because of the loss of copper wire involved. Many coil forms and small motors containing nylon parts are found in automotive electrical equipment, including starter solenoids, accessory motors, etc. Nylon fuse holders not only provide excellent insulation at automotive voltages, but also have adequate heat resistance and toughness, and offer production economies.

In an insulating section of an automobile voltage regulator base, molded nylon provides the necessary insulation and also serves as a chassis for assembly of the various electrical components. Adoption of this part resulted in con-

siderable cost savings because it eliminated the need for a tedious hand operation of inserting insulating sleeves for each mounting rivet.

The facts that molded nylon gears run quietly, usually require no lubrication, and eliminate the need for the extremely close tolerances necessary with metal gears, help to explain the growing use of nylon gears by automotive manufacturers. A one-piece speedometer take-off gear and shaft developed by one manufacturer exemplifies this type of application. This injection molded part combines economy of production and long service life. Another manufacturer employs nylon for the speedometer driving gear, speedometer driven pinion, and an adapter. A 48,000-mile road test of this gear train revealed no perceptible wear.

In the speedometer mechanism itself, freedom from noise and absence of lubrication problems have encouraged two manufacturers to specify nylon gears. The quietness of an electric windshield wiper motor used in the automotive field also depends to a large extent on the use of a molded nylon gear.

#### One-shot lubrication

Among the most unusual applications of nylon in the 1956 cars are the lengths of extruded nylon tubing used in the Multi-Luber, a powered lubrication system available as optional equipment on Lincoln and Mercury cars and also available directly from the manufacturer, Lincoln Engineering Co., St. Louis, Mo., for installation on certain late model cars. In this system, whereby a car can be lubricated by pressing a button mounted on the dash panel, a master cylinder located in the engine compartment is connected by means of nylon tubing to the grease fitting on each front end chassis bearing.

Nylon's toughness, flexibility, resistance to heat and cold, freedom from rust and corrosion, and ability to withstand contact with greases and other chemicals were important factors in specifying the material for this application.

### Other plastics

One of the very newest and most promising plastics to make its appearance in the 1956 motor cars is Mylar sheet material, metallized on one surface and bonded to a backing such as unsupported vinyl, fabric-backed vinyl, or cellulose acetate butyrate. The broad potentialities of this versatile new product, in the automotive as well as numerous other fields, were indicated in a recent article (see "Mighty Beauty," Modern Plastics 33, 85, Nov. 1955). The striking appearance of metallized Mylar, along with its durability and wide range of application, makes it a potent new tool for automotive stylists.

At least three of the 1956 lines of cars—Dodge, De Soto, and Studebaker—are now making use of attractively embossed metallized Mylar panels for interior trim on the inner section of the

doors, just below the window line. Having approximately one-third the tensile strength of steel, Mylar lends additional strength to any material with which it is laminated, providing a new type of interior trim which combines beauty, scuff resistance, and unusual durability at lower cost than embossed metal panels.

Metallized Mylar is also being used currently by several auto manufacturers for upholstery welting, where it again provides an unusual combination of beauty and durability. On the new Studebaker Hawk sports-type cars, which include four models, this type of welting is employed effectively in combination with new washable fabrics, including interwoven Mylar and nylon and similar weaves of metallic Lurex and nylon.

**Butyrate**

Cellulose acetate butyrate, long established as the favored plastic material for optional de luxe-type steering wheels and standard equipment steering wheels on cars in the higher price categories, is finding continuing and highly successful application in the 1956 cars.

Butyrate also continues to find favor for a number of interior components such as gear selector levers, parking brake and seat adjustment handles, window regulator knobs and escutcheons, and miscellaneous control knobs for lights, windshield wipers, etc. For applications of this kind, butyrate provides a desirable blending of properties, including limitless color range, toughness, chemical resistance, a pleasant "feel" to the touch, and the ability to be injection molded at high speed for economical production. These qualities have played an important part in butyrate's continuing popularity for molded arm rest bases—an application which accounts for a sizable volume of the material each year.

An entirely new application for butyrate this year consists of the injection molded buttons used in the new "push button" automatic transmission selectors used on Plymouth, Dodge, De Soto, Chrysler, and Imperial cars.

Actually, these plastic parts are considerably more than buttons, since they measure approximately 3½ to 4 in. in length and have a cross section of approximately ½ by ⅝ inch. They are injection molded in transparent material, with the respective letters N, L, D, and R deeply depressed in the outer face. After molding, the parts are put through a semi-automatic rotary painting operation in which the letters are filled in and the area surrounding them finished in a contrasting color. The buttons are internally lighted.

All in all, the new 1956 automobiles make it crystal clear that plastics are firmly entrenched in the automotive field. Changing concepts of design and interior appointments, the new emphasis on safety, and the continuing interest in more colorful, functional materials are but three of the factors which lead one to predict that, despite the remarkable progress made to date, "this is only the beginning."—END

## Formed for lighting

(*From pp. 108-109*)

forming the various fixtures range from simple lathe-turned phenolic-paper laminate shapes to the more complicated forms cast from phenolic or made from spun aluminum and steel. A cast aluminum mold is used for the bridge lamp shade to impart texture to the formed piece.

Removable mold sections which can be withdrawn when the formed piece is ready to be taken out of the mold are used to produce the undercuts described above. On all three pieces, undercuts are also formed in the appropriate top or bottom sections (depending upon how the fixture is to be used), into which the brass socket ring can be snapped and subsequently cemented securely in place.

After forming, the only finishing necessary consists of removal of trim and die cutting of necessary openings.

According to Lam engineers, the success of the formed fixtures is a direct result of the combination of production economies and high styling obtainable through vacuum forming with the advantages inherent in the plastics materials themselves. Whether formed of rigid vinyl or high-impact styrene, the plastics fixtures are durable, easy to wash and maintain (they have been specially treated to prevent dust attraction), fire resistant, colorfast, light in weight, and have outstanding light diffusion qualities long recognized by lighting engineers.

Consumer enthusiasm for modern, practical fixtures that fall within the range of the average pocketbook is expected to result in substantially increasing interest in plastic sheet forming by more and more lighting engineers.

*Credits:* Vinyl sheet for bubble lamps supplied by Nixon Nitration Works, Nixon, N. J.; high-impact styrene sheet for bridge lamp and clip-on diffuser based on Dow Chemical Co.'s 475 resin and supplied by The Gilman Bros. Co., Gilman, Conn. Vacuum forming equipment from Auto-Vac Co., Bridgeport, Conn.

## Potting

*(From pp. 125-137)*

tion is in high-temperature solenoids, fire-wall connectors, motor coils, and chemically resistant electrical devices.

### Selection of insulation

In potting or encapsulating an electrical device it is important to select carefully the materials that go into the electrical components to be potted.

For instance, if capacitors are used, they should not be the ordinary wax-dipped paper-case variety, since the wax will melt and migrate to cause inclusions. A molded or metal-encased unit would be better.

Sleeve insulation on wires should not be made of plasticized vinyl, because of the poor adhesion of the resin to such surfaces; because air will probably be entrapped; and because the plasticizer may boil and bubble during curing. A plain unvarnished cotton, paper, or fibrous glass sleeve will serve far better; such materials are thoroughly impregnated during potting and the potting resin usually has a higher resistivity than ordinary sleeve materials.

Enamel insulation for wire should preferably be of Formvar (a Shawinigan polyvinyl formal enamel), which resists the solvent action of some of the amines and resin diluents, rather than of plain enamel which does not. Unsized paper and unvarnished cotton are desirable insulation spacing materials because their capillary structure is a great aid to impregnation.

When electrical assemblies such as printed circuit plates which contain vacuum tubes with fragile glass envelopes are to be potted, it is best to use a resin that shrinks very little upon cure. This prevents the development of excessive pressures on the tube walls. Adding plasticizers speeds the relaxation of stresses and helps prevent tube damage.

Since vacuum tubes, resistors, transformers, and other electrical components generate heat during operation, the potting medium should have good thermal conductivity. This can be increased

by packing glass beads or dry, coarse, salt-free sand around the components before impregnation and potting. The arc resistance of the resin can also be greatly improved by adding mica or asbestos in relatively large percentages.

The vapor transmission and water absorption of resins can sometimes be reduced by adding a few percent of a suitable isocyanate or silicone.

### Cure

As was mentioned above, a complete cure, i.e., 100% completion of the main and side condensations, rarely if ever occurs. Some resin systems are better than others in this respect. The degree of cure and elimination of polar or reactive groups from the resin is a determining factor in the physical, electrical, and solvent-resistant properties of the polymer. For that reason, optimum cure is gained by using the maximum temperature for the longest time within economic limits. If a choice must be made between a long time at a low temperature or a relatively short time at a high temperature after gelation, the latter will give the best results, provided the components or the resin are not damaged by the process.

The type of oven employed can have considerable bearing on the results obtained with any one resin system and job. The best type is indirectly heated, in which air is circulated at high velocity with part of the air bled off to the outside of the building. The high-speed air heats the components and helps to take away any excess heat of reaction that may build up in the resin, thus preventing damage or bubbling.

For routine potting it is sometimes advantageous to pour the resin and experiment to find a temperature at which gelation takes place within one hour. After hardening has occurred, the temperature can be raised to the maximum that the resin or components can tolerate. This procedure will usually yield a casting with lower frozen-in stresses and better electrical and mechanical properties than one that has been allowed to go through an uncontrolled high exotherm.

### Impregnation techniques

There are two effective methods for deep impregnation: the vacuum method and the centrifugal method. In principle, the vacuum method is simple, consisting of four steps. First, the article to be impregnated is heated under a vacuum of about 20 microns or better to pull out water and other volatiles. Next, the impregnation resin is admitted and allowed to cover the article and the vacuum is re-applied until bubbling ceases. This gets the air out of the interstices. Then air is admitted to the chamber and the resin is forced by the one-atmosphere difference in pressure and by capillary action into the interstices. Finally, the article is removed from the tank, allowed to drain, and cured.

For potting, the technique is similar except that the electrical device is contained in a "pot,"

(*To page* 251)


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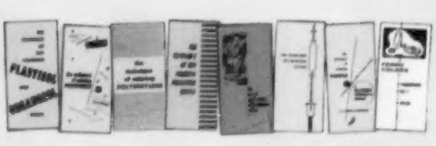

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such as a can or molded case. Dehydration is best obtained by baking the whole assembly in an oven at 230° F. for several hours and then placing it in a vacuum chamber to cool with the vacuum on. Dry air or gas is then admitted and the resin is poured into the mold. The chamber is then closed and vacuum drawn. After all bubbling has ceased, air is admitted and the molds placed in an oven for cure. The process is diagrammed in Fig. 6, p. 132.

If assemblies to be potted, such as paper-insulated coils, are covered with resin without first prebaking them, considerable foaming will take place due to the boiling-up of traces of water or solvents. This will usually result in voids and other defects in the finished coils.

### Ignition coil potting

An example of the use of the centrifugal technique is the commercial production of ignition coils where such factors as cost, quality, ruggedness, and reliability are very important.

The ignition coil in question had to operate under severe conditions on a one-cylinder, air-cooled chain saw equipped with a fly-wheel magneto. The coil is mounted on the cylinder, and temperatures up to 250° F. can be encountered. The vibration during operation is high and the coil must be rugged. Forest humidity is often high and the coil is expected to operate efficiently under wet conditions. The high voltage generated across the secondary winding should be about 18,000 v. under all these conditions.

Earlier coils gave considerable trouble with electrical breakdown because of water penetration. These coils were vacuum-impregnated with electrical varnish, baked, placed in a phenolic case and filled with a pitch potting compound. Over a period of time the pitch shrank away from the case and formed cracks to the windings. The makers searched for more suitable materials of construction, and after working with all the available potting materials they decided that the epoxy resins were best.

The original thought was to replace the pitch with epoxide and use a varnish-impregnated coil; but tests of epoxy-impregnated and encapsulated coils showed a 25% increase in output voltage. Moreover, none of the coils made this way could be broken down by the full output of a coil tester.

A study was then made of the facilities required for vacuum impregnation for production and, because of the space required, resin pot life, and labor involved, other methods were considered. Centrifugal impregnation seemed to hold promise, provided the resin could be controlled and the process made simple enough. A single-coil spinner was constructed and tests conducted. After experimentation, reproducible coils of excellent quality were obtained, and a multi-coil machine was built.

The secondary coils are multiple-wound on an impregnated paper core, with about 10,000 turns of #40 single-strand Form-

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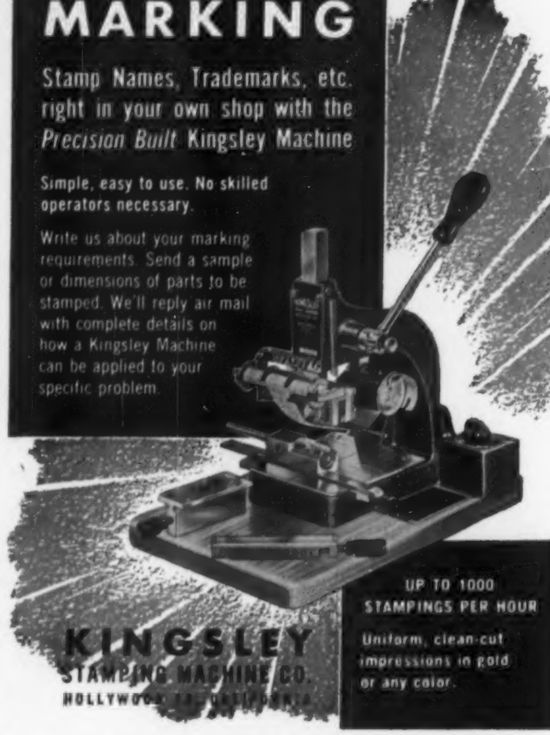

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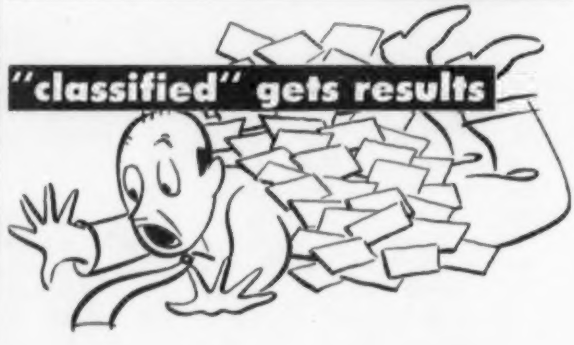


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var-insulated wire, with 0.6-mil paper between layers. The primary, consisting of 100 turns of #19 Formvar-insulated wire, is slipped into the finished secondary. A molded alkyd case with attached terminals closely fits the coil assembly.

The terminal openings are sealed and 24 assembled coils are placed on a rack. The rack is then pushed into a forced-circulation air oven held at 250° F. After one hour it is taken out and while still hot the coils are loaded into the heated centrifugal spinner and resin is poured into each alkyd case. The machine is then started and, after 30 min., the coils are removed with the resin completely set up and hard. They are then placed on a cooling rack, the ends are trimmed off, and the laminated-iron cores are inserted. After testing, the coils are ready for use.

With this technique, the labor needed to produce a large number of coils per day is very small. The amount of resin used is that required to fill the case, and no clean-up is required as it is with other impregnation methods. The losses and rejections from all causes average less than 0.5% as compared to 5% with other methods tried.

**Comparison of techniques**

Production coils made by this technique have better properties than those made by vacuum operations. This is due in part to the fact that impregnation takes place while the coil is hot, and the resin is very fluid. The centrifugal force provides pressures up to 1000 p.s.i. on the resin during polymerization (about 70 times that obtained by the vacuum technique). This produces a pressure casting with more thorough penetration, higher density, higher dielectric strength, and less shrinkage.

The cure is fast because the temperatures are high, and the vapor pressures of the resin components are irrelevant because the mix is under pressure instead of vacuum. At equally high temperatures the vacuum process applied to the same resin produces a badly foamed polymer.

One of the main advantages of

the centrifugal method is the high rate of production that can be maintained. One semi-skilled operator can easily take care of three machines, including mixing the resin, loading the racks for the drying oven, and loading the cooling racks. A schematic diagram of the system is given in Fig. 7, p. 134.

#### Practical techniques

The greatest problem in electrical potting lies in working out a practical technique of application. One of the first things to be decided is the shape of the finished article. If a self-supporting structure is to be made, suitable molds have to be designed. If an outer metal or plastic case is part of the design, the problem is greatly simplified, since sealing the case and pouring the casting under suitable conditions is easy.

This method of potting may be the most desirable since the problem of mold preparation and extraction of the part is eliminated. Less resin is used and more precise positioning of the components can be accomplished.

Where a permanent casing is undesirable or cannot be used, other methods have to be found. Of these the best, where it is practical, is to provide a temporary case that can be stripped or machined off after the resin has been cured. This eliminates mold preparation as well as the requirement of having a large number of expensive molds circulating in the process.

Suitable temporary case materials can be made of paper, molded alkyd or vinyl, or an easily machined or formed metal such as aluminum.

#### Mold materials

In the manufacture of potted motor armatures, for example, it is not easy to maintain complex shapes, sometimes with re-entrant cavities. Unless long runs are expected it becomes prohibitively expensive to make matched metal molds for the purpose. In such cases, vinyl plastisol molds have been very useful—total tooling cost can be less than $100.

The method is to make an aluminum mold shape, corresponding exactly to the contour and

size required in the final article. This shape is heated in an oven to 350° F., dipped into a vinyl plastisol, and after draining, replaced in the oven to fuse the vinyl. The vinyl is then stripped off and allowed to cool. Since the whole process takes only a few minutes, a large number of vinyl forms can be made in a day by such simple means. The armature is then placed in the vinyl mold and jig positioned. The vinyl can be restrained to the shape in a wooden or other form and the component potted.

Figure 8, p. 136, shows a high-performance d.-c. motor armature before potting. Figure 9, p. 136, is the vinyl boot in which the potting took place. A cross section of the finished armature without any machining other than sectioning is shown in the photo on page 125. The mold cost was $55 as compared to $350 quoted for a matched metal mold. The advantage is that only one male mold for the plastisol boots was required, while at least ten of the female matched metal molds would have been required. Potting has been successfully applied even to parts of very large motors. (See Figs. 10 and 11, p. 137.)

Highly polished stainless steel or cast bronze give best release in metal molds. Aluminum has porous surfaces and may drift dimensionally during temperature cycling.

### Mold maintenance

Maintenance of molds for production is a serious and difficult problem. Epoxy resins in particular are excellent adhesives. If the operator should err in applying the parting agent, the part may be lost or, worse, the mold may be damaged by efforts at removal. Since such metal molds represent a considerable capital investment it is advisable to examine other techniques as well.

Teflon molds have been successfully employed for short-run production of expensive components, in spite of the high cost of Teflon. Unfortunately, the dimensional stability of block Teflon is not all that could be desired under continued thermal cycling.

Massive Teflon is made by ap-

(*To page 262*)

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plying pressure and heat to Teflon powder to produce a fused block. Considerable non-uniformity exists throughout the block due to variations in density and degree of fusion. This results in localized areas with severe stresses locked in. Heat treatment diminishes these but seldom eliminates them entirely. If a mold machined from Teflon contains areas of varying thickness throughout the mass, the stresses will relax during the thermal cycling in differing degrees and the slab will distort.

The condition can be further alleviated by rough-machining and heat-treating the block at elevated temperatures for several hours. The treated block is then finished to dimensions. Molds carefully made by this technique have lasted as long as 200 cycles before they have had to be replaced on account of distortion.

**Sprayed-metal molds**

A technique for making an approximation to a matched metal mold at low cost is the use of sprayed-metal molds. Low-melting alloys, such as the Cerro series, have properties that permit the production by spraying of intricate and accurately dimensioned components at a low cost.

For example, a master shape can be made by carving, molding, or any other means, in a material capable of easy removal, such as soap, wax, modeling clay, or a lower-melting alloy than the one to be sprayed. A separating composition is applied and the surfaces sprayed with a special metal spray gun until a coating of, say, 0.020 in. is built up. The core is then removed by melting and the shell used for the potting, which can proceed normally from that point. When that shell is no longer needed, the metal can be melted down and re-used.

This method is extremely useful for prototype development work where only a few units are needed, and in cases where internal re-entrant cavities and precise detail are required.

**Future developments**

It is anticipated that within the next few years the prices of epoxy resins, silicones, and polyure-

thanes will drop, both because of increased production resulting from growing demand and the development of new raw material sources. Lowered resin costs should open the field of electrical potting and encapsulation to a point where old-time electrical impregnating varnishes will disappear from the scene. Epoxy formulations are already available with heat distortion points up to 480° F.; a few are now being offered with catalysts already mixed in that have shelf lives at room temperature of at least six months.

The silicone resins have been improving over the years to a point where Class H potting materials with the handling characteristics of an epoxy resin are now available on a development basis. The cost, presently very high, will probably drop in the near future as increased demand makes possible more economical production.

New polymers based on inorganic/organic, silicone-like structures can be expected but they will be based on other polyvalent metals such as boron, antimony, titanium, or zirconium. These can be expected to give still better temperature and electrical characteristics than the silicones. Boron polymers have already been prepared and tested but are not presently commercially available.

Problems of automatically proportioning, mixing, and delivering precisely measured quantities of catalyzed resin have already been solved, and several devices of more or less complex construction are available for the purpose. Such gadgets are a start toward complete automation—machines that automatically load components into molds, mix resins, fill the molds with the exact amount of resin, subject the moldings to fast curing cycle using heat (possibly from high frequency), test finished components, and pack them for shipping.

In a limited fashion this has already been done and some degree of automation should become common practice very shortly where long runs of components such as capacitors, resistors, or solenoids are required.—END

## Prestressed plastics

*(From pp. 151-165)*

increase. These losses were experienced over a period of from 7 to 19 months.

Since the laminates were under almost a constant stress, the losses in strength were due to creep. A typical formula is:

$$t = Be^{EU/SRT}$$

where $t$ = time for fracture, $B$ = a material constant, $E$ = Young's modulus, $U$ = activation energy, $S$ = fracture stress, $R$ = gas constant, and $T$ = absolute temperature. Schmidt and Marlies ("Principles of High Polymer Theory and Practice," 1948) reported that "this equation was shown to be valid for glass over a time factor of $10^7$. Owing to the exponential character of this equation, the time varies extremely steeply with the stress. A reduction of 30% in the stress increases the duration more than five hundred fold."

Rupture versus time data of this type are usually plotted on semilogarithmic graph paper. The straight lines obtained may be extrapolated safely if not carried too far. Since the prestress decreased as the laminates aged, extrapolation of the time-rupture stress curve produced results representing maximum losses. Figures 11 to 15 contain such curves. Extrapolations were made from periods of 7 to 19 months to five years. While such an extrapolation represents an increase of 300 to 900% in time, it only represents an increase of approximately 25% in the length of the curve. The curves, with a few exceptions, displayed similar slopes. The properties obtained by extrapolating the property versus time curves to a period of five years are shown in Figs. 11 to 15. Laminates considerably prestressed lost less percentagewise than those that were prestressed to lesser extents. An example of this is shown in Figs. 2 and 3. The constant difference in flexural breaking strength between the curves representing the unaged and aged laminates (Fig. 2) was approximately 15 pounds. At a prestress of 2000 p.s.i. this represented a loss of 13.9 percent;

*(To page 268)*

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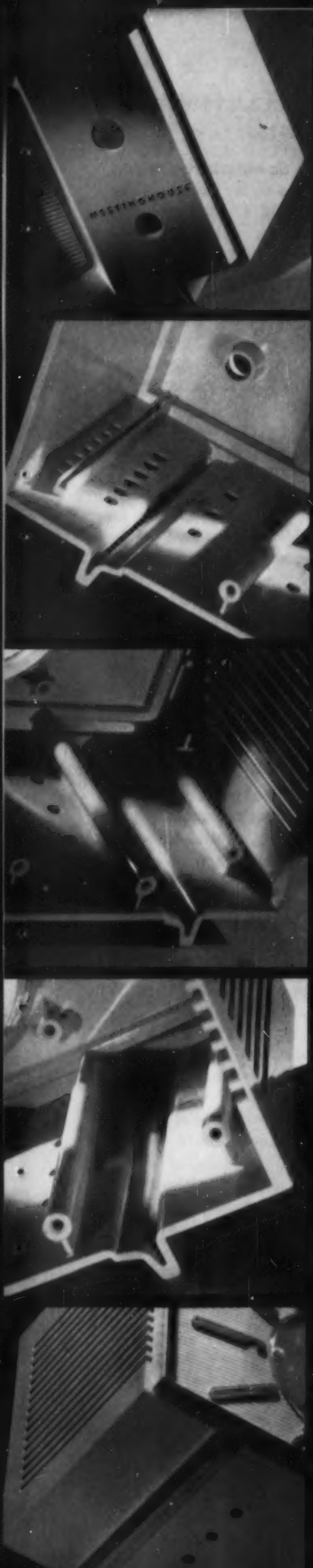
at 5000 p.s.i. this represented a loss of 9.2 percent. The data on the flexural moduli were quite scattered but it is significant that the slope of the curve for laminate 26 (Fig. 13, p. 165), which had an initial prestress of approximately 9600 p.s.i., was the same as the slope of other laminates with much lower prestresses. Average stiffness data after aging produced quite consistent results as shown in Fig. 15, p. 165. Figure 5, p. 159, which shows the average stiffness versus prestress curves for 128-114 cloth before and after aging, indicated very little loss at the higher prestresses. It was expected that losses due to creep would be higher at the higher prestresses.

*Temperature effect.* No experiments were performed to determine the effect of low or elevated temperatures on the prestressed laminates. Previous experience has indicated increased strength at low temperatures and reduced strength at elevated temperatures should be expected for polyester resin-glass fiber-reinforced plastics. Creep would be accelerated at elevated temperatures and the prestress would be lost. In attempting to perform a 3-hr. boil test to determine the wet strength of various finishes on 181 cloth and polyester resin, it was found that prestressed flexural specimens were destroyed by peeling of the prestressed elements. This did not occur in the 30-day immersion test, nor with the epoxy laminates. It is believed that heat-resistant resins would retain the prestress at elevated temperatures better than ordinary laminating resins. It is also possible that the additional cross-linking imparted to the ordinary laminating resins at elevated temperatures would reduce creep and loss during aging.

**Remarks**

It must be remembered that this report represents merely a small investigation into what probably represents a large subject. As such, it has merely scratched the surface. It became obvious during the investigation that there would be ramifications that could not be considered because of the time element. For example, the laminates have been stressed uniaxially. It is possible that better results would have been obtained if the laminates had been stressed biaxially. Only the outermost layers of prestressing elements were prestressed. Better results might be obtained if more layers are stressed. The glass content study was inadequate. More work should be done in this direction. Although most of the commercial finishes on glass were evaluated, the reason for some of the unusual results obtained remain unanswered. Calculated expected life of the materials have not been proven. No tests were made on vibrational fatigue. No work was done on the effect of loading the prestressed specimens for extended periods of time. Data on flexural moduli were inconclusive. Resins cured at elevated temperatures might be studied to determine the effect of cross-linking on prestress and aging.—END



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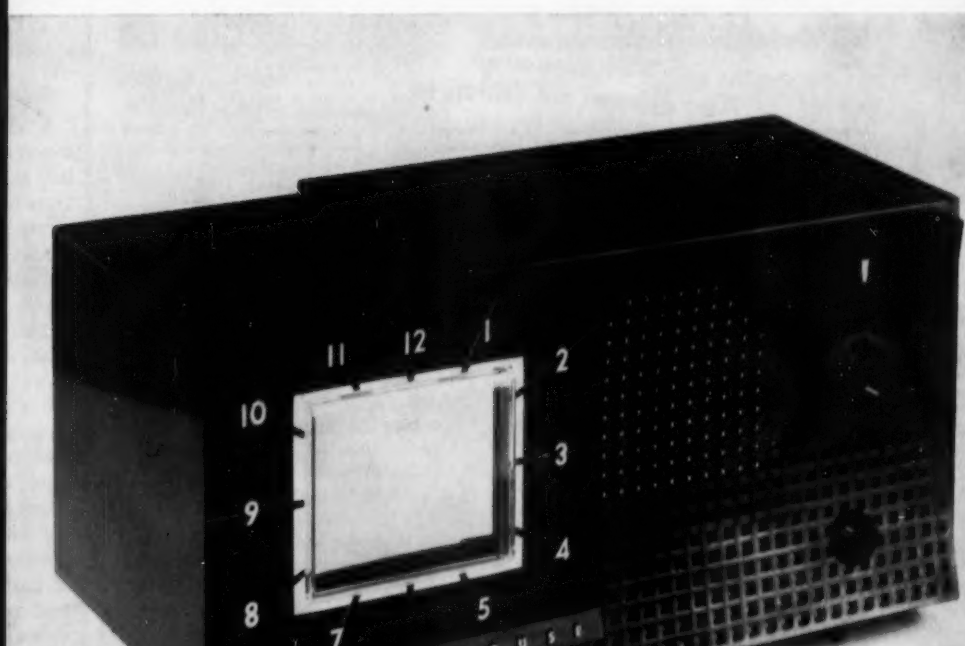


**Westinghouse radio cabinets are molded by Worcester Molded Plastics Co., Worcester, Mass. and Bridgeport Molded Products, Inc., Fairfield, Conn.**

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## Plastics in water pipe

*(From pp. 166-173)*

rinsed with de-chlorinated water, and the rinse water examined for the presence of *E. coli.* Although in some of the test procedures, small residuals of *E. coli.* were recovered following treatment, these numbers were so small as to come within the criterion of chemical disinfection ordinarily considered to be satisfactory. The results indicate that such systems can be satisfactorily disinfected by standard disinfection procedures.

In experiments using high concentrations of chlorine on the various plastic classifications no adverse effects were noted on the plastics after 20 hr. exposure at 10° C. Adverse effects on copper and galvanized steel specimens were noted, however, when these were held under similar conditions. Higher than usual concentrations of chlorine may be used in the disinfection of plastic pipe without damage.

### Animal feeding

Studies were made of Wistar strain rats that drank, exclusively for 18 months, water that had been held in contact with various groupings of plastic pipe. This included a group containing substances such as lead and cadmium which had been found to be extractable with the test water. Also, a control group of rats was observed, that drank exclusively the test water without contact with plastic, and another group that drank only the test water after contact with copper pipe. Observations and tests of rats dying or sacrificed before the expiration of 18 months, as well as of the 36 sacrificed at the end of that period, showed no appreciable abnormal effects as compared to the control group. Growth, food consumption, and water consumption were similar in all the groups. The results of autopsies, as appraised by an expert, Dr. Carey P. McCord, showed no evidence of any damaging action finally attributable to the test plastics.

The groups of rats fed on water in contact with special specimens of plastic pipe containing lead,


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cadmium, and barium, did not show excessive amounts of lead in the blood at the end of the feeding period.

**Practical application of results**

The reported favorable results apply to the particular formulations of plastics tested. It remains to identify these formulations so that the man in the field may identify them on the job and to provide for the testing and similar identification of new formulations that have been developed for use in plastic pipe.

A plan has been devised calling for the testing, regular retesting, and listing of plastic materials satisfactory for potable water supply use, with certification to pipe extruders of such materials. The plan also calls for the marking of approved plastic pipe at intervals of not more than 18 in. with the National Sanitation Foundation's seal consisting of the letters nSf and optionally the addition of the words "Drinking Water." Authority to use this seal is based upon a preliminary inspection of the extrusion plant with reinspection as often as required but at least annually and also the retesting of samples of extruded pipe as required but at least annually. The right to use the seal of approval may be withdrawn at any time for failure to maintain required standards.

**Conclusions**

This study has shown that plastic pipe of certain types including those commonly recommended by the manufacturers for water supply use when properly installed does not introduce toxic substances, affect color, flavor, or odor of the water, nor interfere with maintaining chlorine residuals in such water, nor in the disinfection of new pipe lines by the standardized procedure. A plan has been developed and now is in effect for placing a controlled hallmark on plastic pipe that on test has been found to be suitable for use with potable water supplies, thus giving the engineer a practical basis for identifying and specifying plastic pipe suitable for this use. Other criteria must be used to select pipe for its physical characteristics.—END


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The price is *low*, too, calculated on a volume basis (thanks to the low specific gravity—0.900), making this new low temperature plasticizer well worth an immediate evaluation.

For technical data and an evaluation sample mail the coupon today.

### Admex 745 Specifications

| | |
|---|---|
| Acid Value (Max.) | 1.0 |
| Color (Gardner Holt '53) | 3 |
| Viscosity @25° C. (Stokes, approx.) | 0.5 |
| Refractive Index (Approx.) | 1.451 |
| Specific Gravity @25° C. (Approx.) | 0.900 |
| Lbs. per gallon (Approx.) | 7.48 |

ARCHER-DANIELS-MIDLAND COMPANY
761 Investors Building
Minneapolis 4, Minnesota

Yes, please send free information on Admex 745, the new low temperature plasticizer.

☐ Technical Data ☐ Evaluation Sample

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Other ADM Products: Linseed, Soybean and Marine Oils, Paint Vehicles, Synthetic and Natural Resins, Polyesters, Fatty Acids and Alcohols, Hydrogenated Glycerides, Sperm Oil, Foundry Binders, Industrial Cereals, Vegetable Proteins, Wheat Flour, Dehydrated Alfalfa, Livestock and Poultry Feeds.

## Epoxy-ether resins

*(From pp. 174-176)*

or higher are recommended for use with the reactive fatty acids in order to get low acid numbers before gelation. Rosin, rosin acids, tall oils, dimer acids, etc. may also be used in the esterification reaction to produce a range of resins with non-drying and drying characteristics depending upon the amount and type of acid modification. The resin esters are hard resins which may be subsequently cooked with oil to form oleo-resinous varnishes.

The toughness and resistance properties of these esters is entirely beyond the range of properties that would otherwise have been predicted based strictly on oil length. For example, an epoxy-ether ester at a 12-gal. oil length has the elasticity, resilience, and Kauri reduction normally associated with a 50-gal. oleo-resinous varnish. Those esters with drying oil modification greater than 50% will air-dry and serve as excellent vehicles for floor varnishes and general-purpose paints.

The effect of oil modification in the esters is to upgrade outdoor durability, speed air dry, and promote hydrocarbon solubility. The introduction of the ester linkage effectively reduces the alkali and general chemical resistance of the unmodified resin. Despite this loss in resistance, the properties obtained with the esters are generally superior to those obtained with alkyds and oleo-resinous vehicles and intermediate in color retentivity. Films modified with amino resins such as the melamine-formaldehyde types are generally superior to alkyd-amines in salt spray and alkali resistance. Epoxy-ether esters compatible in a ternary blend with amino and alkyd resins may be prepared by suitable selection of oil length, fatty acid, and low molecular weight. Such blends usually do not give the improved properties expected.

The esters most widely recommended for amino resin modification contain from 25 to 40% of fatty acids of the cocoanut or dehydrated castor oil type. They all bear residual unreacted hydroxyl groups which may be cross-linked with the amino resins. Where this type of ester is used, premature blistering in tap water and distilled water normally occurs. This is probably related to the presence of these unreacted hydroxyl groupings.

We have now added 6) epoxy-ether resinates, 7) epoxy-ether resinate varnishes, 8) epoxy-ether fatty acid esters, 9) epoxy-ether ester and amino resins, and 10) epoxy-ether and alkyd-amino resins.

A recently developed resin has been described as an "epoxy-alkyd." No test data on the resistance of this new vehicle have been published at this writing.

### Copolymerization

One of the most significant developments in the field of resin manufacture has been the extension of the principle of copolymerization to the field of epoxy-ether esters. Vinylated monomers

such as styrene may be copolymerized with the esters in the presence of peroxide catalysts. These copolymers are characterized by fast air dry and excellent water and alkali resistance. The plastic modification generally upgrades most properties, including color retentivity and outdoor durability. The specific choice of monomer will also affect such properties as flexibility; for example, the use of styrene will produce an inelastic film with poor distensibility.

These two resin developments add to our list 11) epoxy-ether alkyds and 12) vinylated epoxy-ether esters.

These resins can now be seen in their true perspective. The use of nitrocellulose was limited to those blends with which it was compatible. Alkyd resins represented an entire class of chemical compounds capable of infinite variation in composition. The epoxy-ether resins combine the best properties of both, exhibiting not only compatibility but adaptability to a broad range of chemical modification.

Within recent years the impact of institutional advertising by raw material suppliers has resulted in an increasing tendency for industrial paint consumers to specify an "epoxy" finish. It should be quite obvious from the description given above that such a request covers a multitude of possibilities. Each one of the twelve basic types of epoxy-ether formulations given above is capable of almost infinite variation. Certainly the outstanding properties of epoxy-ether resins have made them the greatest new basic *raw material* for the coatings industry introduced since the end of World War II. However, it must be remembered that they have their limitations, too.

In the "good old days" of the paint industry we had varnish makers, alkyd chemists, and lacquer chemists. Probably now we may expect to have epoxy chemists as well. These men will be specialists in the many permutations and combinations epoxy-ether resins permit. Out of their work and not in the magic of a name, will grow the new technology.—END

# The Plastiscope

News and interpretations of the news

By R. L. Van Boskirk

## Section 2 (Section 1 starts on p. 39)

### Markets for vinyl

What is the future for vinyl chloride now that the base price for elastomeric calendering and extrusion resins has gone to under 30¢ a pound?

Now that the time has arrived when United States producers have more than enough capacity to supply the demand for many types of vinyl chloride resins, the pressure is on. Furthermore, foreign capacity is steadily increasing and soon must cut into the 40- or 50 million-lb. United States export market. In addition, several foreign firms are vigorously merchandising their resin in the United States. Some 20 to 30 million lb. were imported in 1955.

Obviously, vinyl chloride capacity should no longer be measured by American capacity only—a world figure would be much more significant.

Judging by continually increasing sales in 1956, it may be that last year's almost unbelievable increase of 100 million lb. or more in domestic sales was no phenomenon. If that increase continues, vinyl chloride may become the first billion-pound plastic instead of the much heralded polyethylene. Many major producers are increasing capacity and smaller ones are coming into the field. However, the recent price declines may tend to discourage new producers, may make any plant of less than 50 million-lb. capacity an economic question mark.

The latest price decline of 2 to 5¢ a lb. means that if the same amount of resin is sold in 1956 as in 1955, total sales will be $20 million or so less. Based on the 38¢ price which was current a year ago, the lost income would be about twice that much.

**Sales drive**—How is the industry going to recoup that loss? The answer is "more intensive selling." That selling job is already under way in nearly every division of this diversified industry.

Rigid or unplasticized vinyl (sheet and pipe are in this classification) holds great possibilities. Sales of this resin type in 1955 were estimated to be 10 to 15 million pounds. A conservative guess is that this volume will double or even go higher in 1956. There is much potential competition in this field from other plastics, but it probably won't be very effective in 1956.

**Can coating**—Another unplasticized vinyl that has been growing rapidly without fanfare is the solvent type used for coatings. Beer can lining is the best known. Some 50 billion beer cans have been coated with this material since 1935. A user of this material says that 4.35 lb. of vinyl solution will coat 1000 cans; therefore, the amount of solid resin used since 1935 for this purpose would be around 43 million pounds. About 20 billion glass and metal beer containers are used each year and the vinyl-coated metal is continuing to get a larger share each year. About 30 billion soft drink units are used each year and vinyl-coated metal is now beginning to move in that market.

There are many other uses for this coating-type material. They include coating of oil equipment, paperboard milk cartons, caps and closures (catsup in particular), collapsible tubes, pipes, tanks, freight cars, and all sorts of maintenance equipment. There are also the cocoon-type strippable coatings which have by no means as yet reached the high levels of application that had been expected of them.

**Wire coating**—Cable and wire coating should also continue to grow. Volume last year was around 80 million pounds. At one time a ceiling was placed for leveling off when total volume reached 120 million pounds. But volume is growing so fast that no one would now attempt to guess at a ceiling. Lower prices have undoubtedly helped vinyl wire coating to move in on rubber, its arch competitor for this job. It's even moving in on the specialty rubbers.

As long as electric power plants continue to expand, a continuing increase can be expected for vinyl-coated wire and cable. Other uses for vinyl-coated wire, such as in boats, autos, and airplanes, continue upward. The new B-52 bomber, for example, carries almost 60 miles of wire and much of it is vinyl coated. A decline in construction and automobiles, and competition from polyethylene and butyl, would of course cut into vinyl usage; but the latter two would go largely into fields where vinyl isn't presently used.

Other extruded forms of vinyl, except garden hose, are steadily increasing. Gasketing for autos, for windows, and for sealing buildings to close cracks and crevices are a few examples, although the coating-type resin mentioned above is also used for this latter purpose.

**Molding**—Injection molding is on the way up from its presently low volume of only a few million pounds a year. New techniques and processes are replacing old equipment. Molders who formerly used plastisols and polystyrene are taking a new look at standard vinyl—especially at the current low price. Bus bars, sockets, plugs, and toys are some of the items involved.

**Plastisols**—So much has been written about the steadily growing use of plastisols that their growth needs no emphasis—everyone knows that it has been almost impossible to keep up with demand for these versatile resins. Now a possible new giant—foam

*Reg. U.S. Pat. Off.

# The Plastiscope

made from plastisols—is on the horizon.

The calenderers, too, are much happier than two years ago. One company just bought a new calender; several others are in the market. Aided by improved backings, coated fabric is constantly biting off a greater portion of the upholstery market. And film producers are enthusiastic about the use of laminates, which are perhaps the fastest growing portion of the industry today.

**Other prices up**—Vinyl chlorides are in a most advantageous spot today. The resin price has declined almost 30% in a year. In the last few months, sheet steel has gone up 3 to 5%; high tenacity rayon rose 3 to 5¢ a lb.; zinc went up ½¢ and lead 1¢ a lb.; heating and diesel fuels increased 0.3¢ a gal.; Douglas fir lumber jumped $5 to $6 per thousand board ft.; synthetic rubber is also probably going to rise in the not too distant future.

Each month since September the Purchasing Agents Assn. has reported higher prices, but the price of vinyl has gone down. Profits are small, but if a producer has big capacity, his volume sales will be tremendous. His customers who have low overhead and a flexible operation that will handle a variety of products, can capitalize on the amazement of the buying public when they find a material that is decreasing in price while all other materials, except food, are on the upswing.

How could any industry ask for a better selling argument?

### Plastics fillet

Making of smooth pattern fillets—a problem which has long plagued the pattern-making industry—has reportedly been simplified through the use of an epoxy trowelling resin made by Marblette Corp., 37-21 Thirtieth St., Long Island City 1, N. Y.

It was found that when otherwise satisfactory leather or plastic fillets were glued onto patterns, they were hard to blend into changing contours. According to Marblette, the use of its evenly-flowing trowelling resin #630 results in better matching and blending of radii.

The difference over previous procedures is that the trowelling resin can be tooled in place. This is done by spreading the epoxy resin over the pattern and forming the fillet with a waxed, chrome-plated ball. The resulting fillets are said to bond permanently in place without shrinkage and to provide exceptional durability.

### Hook-up in vacuum forming

Arrangements have been made between Garrison-Wagner Printing Co., St. Louis, Mo., and W. L. Stensgaard & Associates, Inc., Chicago, Ill., under which Stensgaard will manufacture certain vacuum formed plastics displays for Garrison-Wagner.

Stensgaard began manufacturing vacuum formed plastics about four years ago and last year installed what it claims is the largest vacuum forming equipment in the United States.

Garrison-Wagner will catalog and sell Stensgaard vacuum formed utility products, such as plastic letters.

### Utilitarian monomer

Use of MG-1, the unusual monomer recently introduced by Carbide and Carbon Chemicals Co., is arousing more than usual attention. Its principal use at present is to make possible the production of hard plastisol products, but many other possibilities are predicted.

It is different from most other monomers, such as styrene or butadiene, in that it is practically non-volatile; it has about the same low volatility as D.O.P. It is incorporated with a vinyl plastisol in liquid form and polymerizes during fusion. Thus it can be used to replace part of the plasticizer in a plastisol compound. The MG-1 becomes hard when the plastisol is fused. The amount of plasticizer used can be varied to obtain the desired flexibility of the finished product. Vinyl plastisols have heretofore been limited to production of soft or flexible items. In fact, MG-1 can be used alone without any plasticizer to obtain a rigid article prepared through plastisol techniques.

Polymerization of MG-1 proceeds through the vinyl route. A peroxide catalyst such as tertiary butyl perbenzoate in concentrations ranging from 1 to 3%, based on MG-1, may be required to obtain adequate cure.

MG-1 is a member of the acrylic family, probably methacrylate, but Carbide and Carbon have not yet identified it as such. The price is now $1.00 a lb. but is expected to be considerably lower when usage becomes widespread.

**Use in toys**—First big use is expected to be with plastisols for toys. MG-1 will give them as stiff or hard a surface as the slush molder may desire. Vinyl foam producers are also enthusiastic about MG-1. They believe it will be possible to produce a more satisfactory 2- to 4-lb./cu. ft. vinyl foam with this material; such lighter weight foams would also be less costly.

These developments are, of course, very new and the supply of MG-1 is limited but growing. It will take some time to gain the experience necessary to handle it successfully. This is no overnight sensation that will suddenly set the industry aflame, but it certainly seems to have unusual potentialities.

**Other uses**—There are many other avenues of usefulness for MG-1, but they need further study and investigation. It is possible that it may become a useful monomer when used alone—it could become a leather or paper stiffener, for example, where it could be polymerized in place. As a copolymer, it can be used not only with vinyl chloride but also with styrene, vinyl acetate, acrylates, and others. It is also worth investigating in "hot-processing" of vinyl compounds by calendering, extrusion, and molding. Possibilities listed in a Carbide and

## The Plastiscope

Carbon bulletin include compounds for flooring, doll parts, toys, balls, wire coatings, tank linings, foams, gaskets, coatings on electroplating racks, or almost anywhere a plastisol is desirable.

Among the unusual characteristics of MG-1 is that, although it is now suggested as a material for imparting hardness to plastisols, it will also impart flexibility to vinyl acetate when used as a copolymer and thus become an agent to help produce more flexible films from vinyl acetate paint emulsions. It seems to be a wonderful chemical for investigation by curious technicians.

### Craze-resistant glue

Tradenamed Catalin Resin 8666, a new, liquid modified urea-formaldehyde adhesive resin developed to yield durable craze-resistant bonds, has been announced by Catalin Corp. of America, 1 Park Ave., New York 16, N. Y. It is claimed to offer the exceptional craze-resistant quality which is required where lack of adequate clamping pressure or irregularity of contacting surfaces make it impossible to obtain thin uniform glue-lines.

The resin is suitable for gluing wooden structures, edge bonding, cabinet work, and bonding of decorative laminates and hardboard.

### Arc-resistant phenolic

By adding submicroscopic particles of silicon dioxide during the original compounding of phenolic resin, Westinghouse Electric Corp., Pittsburgh, Pa., claims to have developed a molding formulation which increases the resistance of molded electrical insulation to electric arcs by as much as 1000 percent. In view of the well-known low arc resistance of molded phenolics, this development is regarded as highly significant.

The new compound, tentatively referred to as "silica phenolic," has passed the laboratory stage; it is anticipated that it will find its way into many future Westinghouse products. At the present time, Westinghouse does not expect to sell the material to other firms but will use it only in internal production.

### Isocyanate plant

Isocyanate is now in commercial plant production at a new $10 million Du Pont installation at Deepwater Point, N. J., across the river from Wilmington, Del. Du Pont has been producing the material, called Hylene, in pilot plant amounts for a year or two, but the new plant has a capacity of 25 million lb. a year. It is estimated that about 10 million lb. will be produced this year in comparison with an estimated total of 1 million lb. of isocyanate sold in the United States in 1955.

Some of the raw materials used in isocyanate production are nitric and sulfuric acid, toluene, chlorine, and natural gas or propane.

Some 50 firms have taken out licenses to produce either rigid or flexible urethane foam, which is by far the largest volume product presently made from isocyanates. However, only 10 or 12 of these licensees are actually in commercial production.

Du Pont does not produce the adipic acid-glycol type of polyester resin which is used with isocyanate to produce polyurethane foam, but does claim patents on the reaction product obtained when the two are mixed together to produce a variety of end products. The two chemicals are mixed in a proportion of around 25% isocyanate and 75% polyester to obtain urethane foam.

**Uses for foam**—The foam has present or prospective uses in seat cushions, dashboard and sun visor crashpads, rug underlays, sponges, insulating liners, shoulder pads for clothing, falsies, tow targets, X-ray position pads, and many other as yet untried applications. Perhaps it can even be made resilient enough for mattresses. Various degrees of flame resistance are also possible.

Conceivably, cushioning may some day be made by simply lining a mold with fabric, then forming and upholstering in a single step by a simple pouring operation. No adhesives, tacks, or sewing would be needed.

Rigid foam which can be foamed in place and needs no adhesive for attachment to walls is thought to have great potential for sandwich material in construction panels, home freezers and refrigeration, pipe insulation, and aircraft structures.

Other uses for isocyanate include surface coatings, wire coating, adhesives, and rubber. It started business in this country as an adhesive for sticking rubber to fabric in life vests. So-called polyester rubber, which received wide publicity a year or two ago as the rubber for a possible 100,000-mile tire, is made from isocyanate and polyester, with a smaller percentage of isocyanate in the mixture than is used in foam. However, this rubber, called Adiprene by Du Pont, is thought to be many years away from actual use as a tire material.

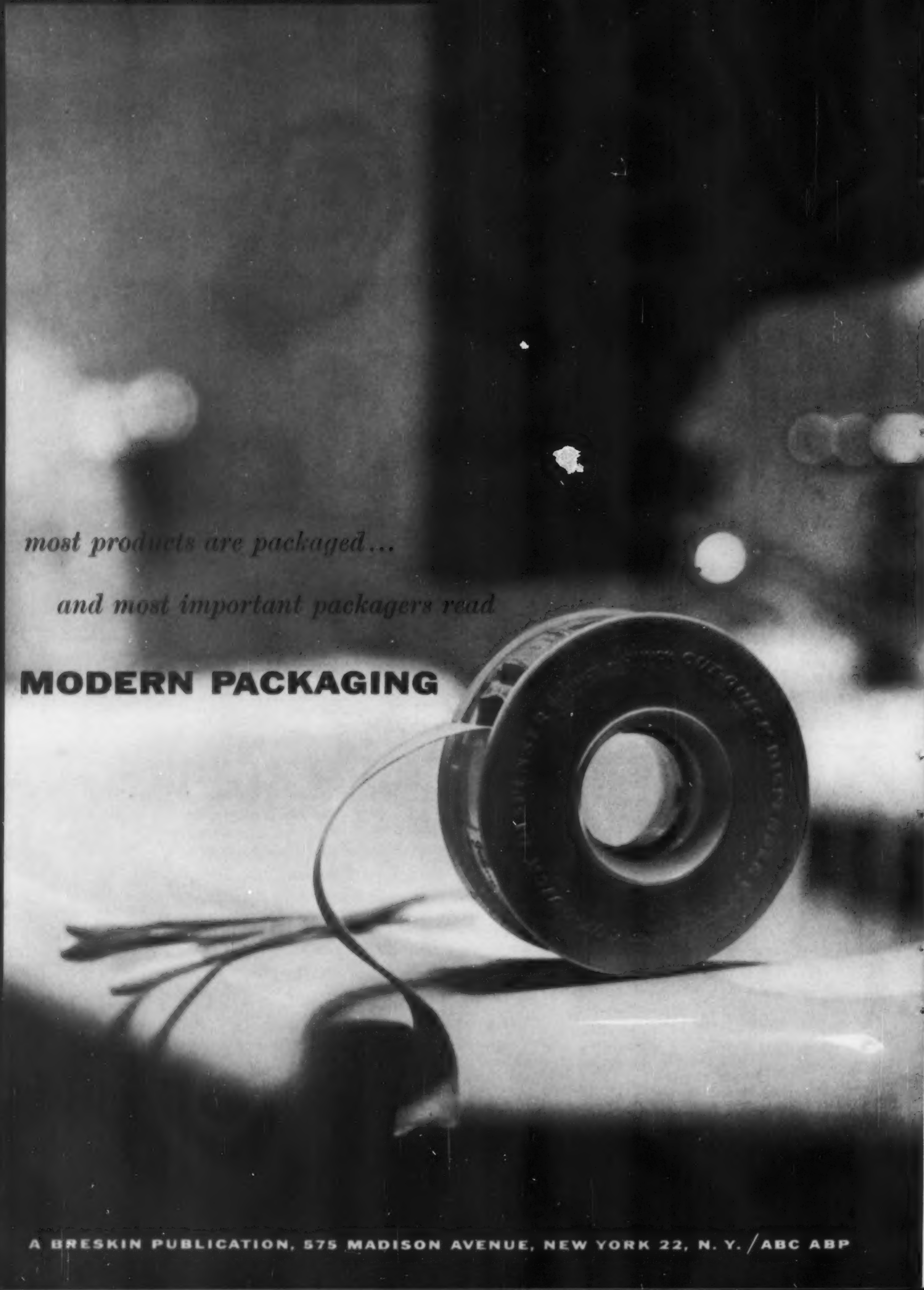
Isocyanate has been widely and successfully used in Germany for several years, but there has not been a large quantity available in this country.

Mobay Chemical Co., a joint enterprise of Bayer-Farbenfabriken of Germany and Monsanto Chemical Co., will soon open a new plant in West Virginia to produce isocyanate and the polyester resin to use with it.

National Aniline expects to have an isocyanate plant on stream late this year.

**What to call the foam?**—Hudson Foam Co., Yonkers, N. Y., has been marketing a foam material which it calls polyester foam. Hudson officials claim it is their own development and is a strictly independent operation. It is well known that a large mail-order house has been distributing Hudson foam for upholstery and similar applications.

Marketers of urethane or isocyanate or polyester foam—whichever it may be called—are concerned about a complex patent and license system which may be


most products are packaged...
and most important packagers read
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# The Plastiscope

a handicap to promotional merchandising, but are hopeful that the principal companies involved will settle their various disputes so that foam producers may go about their business without hesitation as soon as sufficient material is available.

**Midwest S.P.I. to meet**

A Midwest conference, planned along lines of the New England and Pacific Coast conferences, will be sponsored by the Society of the Plastics Industry, Inc. on April 26 and 27 at French Lick Springs Hotel, French Lick Springs, Ind.

Elmer E. Mills, Continental Can Co., Chicago 3, Ill., is general chairman of the conference.

**Nygen Tolex**

Issuance of Registration No. 618,-754 by the U. S. Patent Office for the name Nygen Tolex for coated fabrics for upholstery material (simulated or artificial leather) has been announced by Textileather Div., The General Tire & Rubber Co., Toledo, Ohio.

Since the introduction of Nygen Tolex, a supported vinyl material, Textileather has produced many new stock lines using this fabric. The outstanding characteristics of Nygen Tolex are its balanced stretch and excellent recovery. The material is easily tailored and has already found wide use in the automotive and furniture industries.

**Better copper clads**

Double the bond strength (12 to 15 lb.) and much higher resistance to dip-solder temperature (30 sec. at 500° F.) than found in conventional copper-clad phenolic laminates are claimed for the HP series produced by National Vulcanized Fibre Co., Wilmington 99, Del. In the manufacture of printed circuits, for which these laminates are used, this means faster production rates (since higher-temperature solder baths are possible), cleaner soldered joints, and minimization of bridging. In addition, bond strength is retained after repeated heating and cooling, according to the manufacturer.

The process by which these improvements have been brought about involves a new method of uniformly conditioning the bonding surface of the copper foil and the use of an improved, heat-resistant adhesive formulation. Both are the result of original research conducted at Houghton Laboratories, Inc. National Vulcanized Fibre developed the equipment to use this process on a continuous mass-production basis.

Two foil thicknesses are currently being offered—0.00135 and 0.0027 inch. Standard N.E.M.A. thicknesses and tolerances apply for the various grades of HP series laminates. Sheet sizes available are approximately 38 by 38 in. (with seam down the middle) or 18 by 38 in. (without seam).

**Hardener for plaster**

A plastic impregnant for plaster of Paris, called Kirk-Kast, is being marketed by Kirkegaard Laboratories, 85 Fifth Ave., New York 3, N. Y. The product comes all ready to use, needs no catalyst or baking, and is claimed to be non-toxic and non-flammable.

When using the impregnant, a dried plaster casting is simply immersed in Kirk-Kast until bubbles stop emerging. The excess material is wiped off or blown off with an air jet.

The Kirk-Kast hardener, when used with plaster of Paris, Densite, or Hydrocal, is suggested for the production of vacuum forming molds. When sprayed with a protective coating, the molds can also be used for casting plastics and for layup molding of reinforced plastics.

The product has already been used in the manufacture of lighting fixtures in the form of high hats for a night club. A special Christmas display, which was used for three seasons without breaking or chipping, was also made from the material.

Kirk-Kast is sold in drum lots at $3.50 per gal., F.O.B. plant.

**New S.P.E. officers**

Election of the following officers for 1956 has been announced by the Kentuckiana Section of the Society of Plastics Engineers, Inc.: president, K. A. Erwin, General Electric Co.; vice president, C. J. Young, Crescent Plastics, Inc., Evansville, Ind.; secretary, W. H. Bailey, Hoosier-Cardinal Co., Evansville, Ind.; treasurer, W. B. Watkins, Premier Thermoplastics Co., Jeffersontown, Ky.

**National Starch appointments**

Formation of a Structural Adhesives Dept. to specialize in this new industrial trend has been announced by National Adhesives, Div. of National Starch Products, Inc.

A. G. Battaglia will head the new group and will be assisted by Joseph Coufal as sales supervisor. Jules Sirota will be in charge of the laboratory development and formulating work.

National Starch also announces that John D. Beggs has been appointed sales manager of its vinyl acetate resins for the paint and other protective coatings industries. Mr. Beggs was founder of Gelvatex Coating Corp. and resigned as president and director to join National Starch. He is a native of England, where he founded and became managing director of Vitretex Surfaces, Ltd., which specializes in cement finishes.

**Guaranteed wall tile**

No effort has been spared by Dow Chemical Co., Midland, Mich., to emphasize its guaranteed polystyrene wall tile program as a means of influencing householders to purchase polystyrene wall tile.

Any manufacturer of Dow's Styron tile may have his product evaluated by Dow's Plastics Technical Service. If it is up to standards set by the Bureau of Standards, he may use Dow's Styron label to identify his tile. The guarantee not only protects the homeowner who wishes to install his own tile, but is also ap-

plicable to installations made by the tile dealer, provided that he follows application procedures included in the Commercial Standards which were established by the Bureau of Standards in cooperation with tile producers. The certificate provided for the customer as a guarantee of quality must be signed and mailed by him to Dow Chemical within 30 days from date of installation of the tile.

Accidents can happen to plastic wall tile, but Dow takes the precaution of warning its customers of these various possibilities and how to avoid them.

About 80% of all polystyrene tile is used for redecorating and remodeling, but it is growing in application for new homes, especially since its acceptance by FHA for insured loans. At least 50 million lb. of polystyrene was used for wall tile in 1955, but that figure is only a conservative guess—actual statistics are not available. Volume has grown steadily for several years; if extruded, striated tile comes up to expectations, a volume of 100 million lb. may not be too far in the future.

### Cementable Teflon tape

Production of Teflon tape, treated for cementing with any commercial adhesive (including pressure-sensitive adhesives) to plastics, metal, glass, wood, or any other surface, has been announced by United States Gasket Co., Camden 1, N. J. The company states that the "material that sticks to nothing" can now be cemented to anything. The pull rating is approximately 45 pounds.

Inexpensive applications of the material can now be made with thin sections (down to 5 mil) for many purposes where Teflon's extremely anti-hesive sanitary surfaces and other properties are desired.

The tape can be used as frictionless facings for conveyor and packaging machine guide rails; frictionless linings for hoppers and tanks to assure uniform feed without sticking; non-sticking coverings for baking pans, cookie flats, and bakery rolls; chemically inert coverings for metal and other surfaces coming in contact with corrosive substances; insulation for electric motor windings and electronic coils, panels, chassis areas, and cases for high-temperature, high-voltage, and high-frequency services; and as easy-to-clean work surfaces.

Teflon tape, treated for adhesion on both sides and laminated to another dielectric for rigidity, also offers excellent possibilities for printed circuit production, according to the manufacturer.

The product is available in continuous rolls up to 12 in. wide and in thicknesses from 5 to 60 mils. Sheets are also being offered 1/32 in. thick in sizes up to 24 by 24 in. and 1/16 in. thick up to 48 by 48 inches.

### Awards for reinforced plastics

At the eleventh annual conference of the Reinforced Plastics Div. of the Society of the Plastics Industry, Inc., Executive Committee awards were presented to John A. Owen, consultant; Arthur J. Wiltshire, Apex Electrical Mfg. Co.; and Charles E. Hoover, Owens-Corning Fiberglas Corp. The awards are in recognition of the efforts of the recipients on behalf of the industry, and they include an illuminated scroll and a lapel pin.

A similar lapel pin, inset with diamonds, was presented to William Cruse, executive vice president of S.P.I., for his support of the organization over the past years.

### Agricultural vinyl

Heavy-duty vinyl tarpaulins for a variety of horticultural and agricultural uses, including steam sterilization of soil and preservation of silage, are being marketed by Larvacide Products, Inc., 117 Liberty St., New York 6, N. Y.

Tradenamed Larvacover, the product is offered to farmers, gardeners, and greenhouse men for at least seven suggested uses. In addition to steam sterilization and silage covers, they are recommended for use as soil-fumigation covers, greenhouse-bench liners to permit double-decking, erosion preventives, irrigation-ditch liners, and water-conservation aids.

The tarpaulins are manufactured from Ultron vinyl chloride produced by Monsanto Chemical Co.'s Plastics Div.

The product comes in heavy-duty and standard thicknesses. Standard rolls are 100 and 150 ft. long and are available in 6½- and 10-ft. widths. Custom sizes will be furnished upon request.

Hemmed ends give the material better tear resistance and make it easier to handle. All seams are made electronically.

### Bamberger forms new firm

Interplastics Corp., 654 Madison Ave., New York, N. Y., has been established by Gerald F. Bamberger, formerly executive vice president and general manager of A. Bamberger Corp. and American Molding Powder & Chemical Corp., Brooklyn, N. Y.

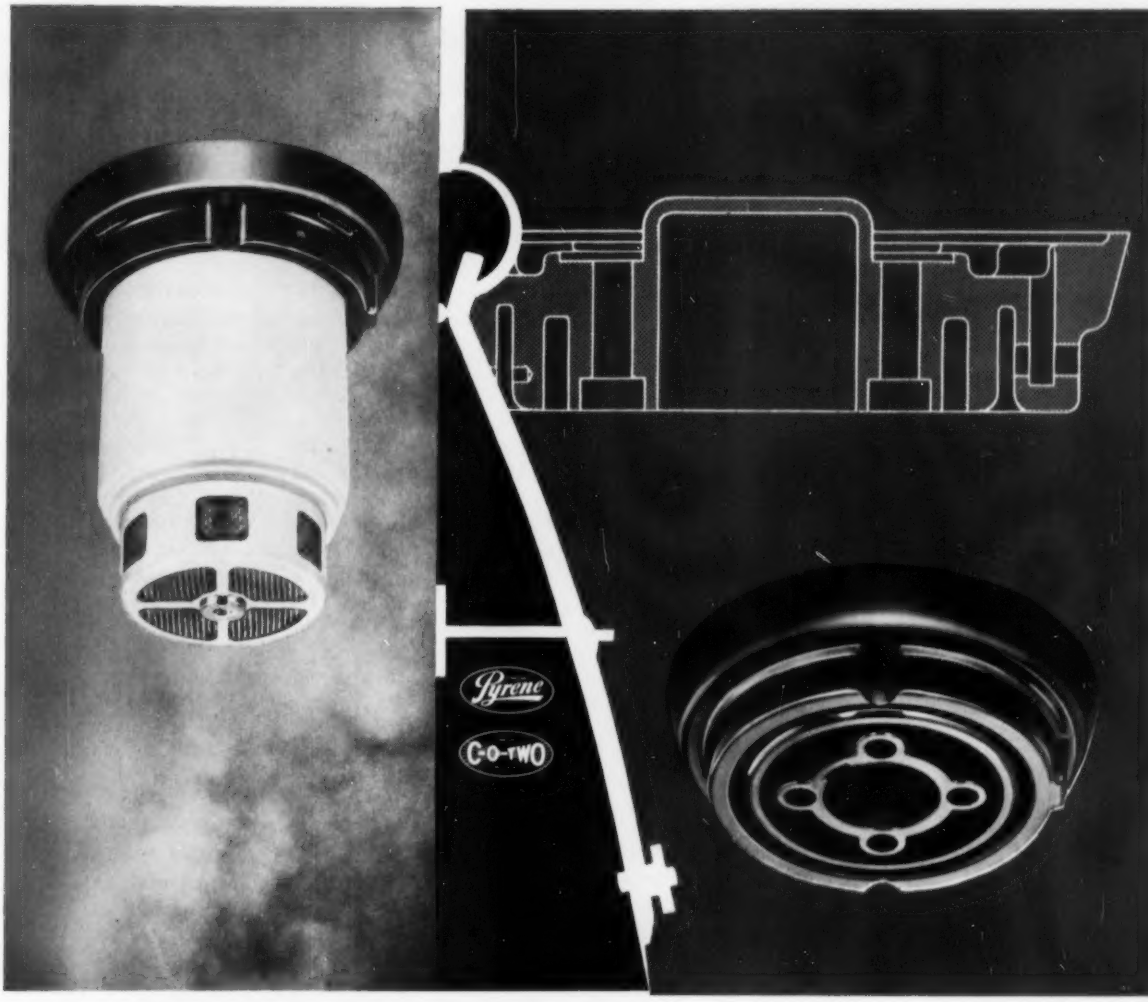
The new firm will supply a complete line of thermoplastic molding powders (both virgin and reprocessed), resins, and raw materials for both domestic and overseas customers. In addition, the company is equipped to meet unusual color and material requirements.

Interplastics will also act as distributor and export agent for American manufacturers of plastics raw material and will import special types of plastics materials.

Mr. Bamberger is president of the new company; Henry F. Meckauer, formerly export manager of American Molding Powder & Chemical Corp., is vice president.

### Foam for boxes

Foamed plastics containers now in the advanced development stage at St. Regis Paper Co., 230 Park Ave., New York 17, N. Y., are claimed to be ideal for packing fresh vegetables and fruit or freshly-frozen meats and poultry. The new lightweight container, in which paper and foamed plas-


Pyrene
C-O-TWO

tic are combined and produced in continuous form, retains high compression strength under conditions of severe humidity.

The company asserts that, from the standpoint of strength and economy, the container should compete favorably in those fields in which expensive wooden containers are now being used. These include the packaging of fresh fruits, frozen poultry and meats, citrus fruits for both domestic and foreign markets, as well as many other applications which are being studied.

**Rubber-plastics meeting**

A two-day conference on electrical engineering problems in the rubber and plastics industries will be held at the Mayflower Hotel, Akron, Ohio, on April 9 and 10. The parley is sponsored by the Subcommittee on Rubber and Plastics Industries of the General Industry Applications Committee of the American Institute of Electrical Engineers.

W. E. Chope, president of Industrial Nucleonics Corp., Columbus, Ohio, and named by Eta Kappa Nu as the outstanding young electrical engineer of 1955, will give the keynote address on Monday morning, April 9. The speaker at the banquet that evening will be W. S. Wolfe, factory manager, Domestic Operations, Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Among the subjects discussed will be silicone rubber motor insulation, irradiated polyethylene motor insulation, epoxy resins for motor insulation, and new developments in dielectric heating.

**Dry colorants**

Dry colorants for polystyrene, high-impact polystyrene, and polyethylene are available in a system called Colortrol, now being promoted by Riverdale Color Co., Inc., 425 South St., Newark 5, N. J. The new color system is based on a prelubricated formula that requires no wetting agents. Company spokesmen say that it will save the molder additional operations and costs and will give him an intensive type of color concentrate which results in better uniformity of dispersion and truer color matching.

Riverdale has been authorized to distribute the House & Garden Official 1956 Home Furnishings colors which are stocked in 16 different shades.

**Scholarships**

Approximately 125 scholarships valued at $51,000 are available at Lowell Technological Institute, Lowell, Mass., according to an announcement by President Martin J. Lydon. Scholarships are available to undergraduate students who elect to study in any of the Institute's degree-granting programs, which include the Department of Plastics Engineering.

**Fluorocarbon insulators**

Califilm, a material made by a newly developed process that imparts superior qualities to films made from Kel-F or fluorothene, is now available from Shamban Engineering Co., 11617 W. Jefferson Blvd., Culver City, Calif. Califilm possesses unusual electrical, physical, and chemical properties and is said to be tough, non-porous, and, in its natural state, clear, colorless, and transparent.

Non-carbonizing, the new film assures positive insulation for resistors, solenoids, condensers, transformers, motors, and generators. Non-wetting qualities and resistance to fungus and hydraulic shock made the material useful in packaging, food handling, gasketing, and diaphragm sealing. Useful temperatures for many applications range from below $-120°$ F. to more than 390° F. Califilm can be autoclaved for sterilization purposes.

Shamban is also merchandising Kelon-T (Teflon), compression-type, miniature and sub-miniature insulators for high-frequency, high-temperature, and high-voltage service in radar, television, and other electronic equipment. Self-sealing and self-fastening, the insulators are claimed to be resistant to heat, humidity, mechanical shock, and vibration, and may be press-fitted into mounting holes with simple tools for fast, economical assembly.

**Polymerization of propylene**

Manufacture of polypropylene by a new catalytic technique is of considerable industrial interest to the plastics industry. German producers are eying the material as potentially "the lowest priced plastics available." A recent Belgian patent issued to Karl Ziegler, of Germany, and to Montecatini Co., of Italy, describes such a process giving details of catalyst, process conditions, and properties of the polymer produced.

Belgian patents are granted without examination for validity and are thus published promptly after filing and are frequently available before patents issue in other countries.

A translation of the patent, Belgian #538,782, filed June 6, 1955, and published December 8, 1955, has been prepared by Chemonomics, Inc., an affiliate of R. S. Aries & Associates, 270 Park Ave., New York 17, N. Y., and sells for $45.00.

**Isoglas electrical insulation**

A glass fabric coated with a newly developed isocyanate-type resin has been announced by Natvar Corp., Rahway, N. J. The resin, called Isoglas, is characterized by its resistance to high temperatures, its extreme toughness, and its ability to bond to glass. As a result, the film is resistant to crazing and is relatively unaffected by rough handling, even at Class B temperatures and above. In addition to its good mechanical, electrical, and physical properties, the coating is claimed to be resistant to most chemicals and solvents, including the Askarels.

The improvement in performance capabilities over conventional types of coated glass fabrics opens up many new uses. Isoglas may now be used with considerable savings in applications where expensive Class H

Drop dart mechanism releases weight-loaded dart on taut film—rates material's shock resistance.

*Drop dart test gives proof of film's shock resistance*

# Super-tough testing assures top performance of Monsanto *Polyethylene*

Putting polyethylene film through its paces is just one of the many tests conducted by Monsanto's Research Laboratories to assure you top quality polyethylene resins. Consider the punishing drop dart demonstration shown here, for example. This test gives a comparative measure of the shock-impact resistance of polyethylene film. It was developed to simulate actual abuse encountered by film packages.

Consider, too, what this kind of tough testing means to your products. Now at a time when your customers—and their customers—are becoming more and more critical of product performance, you can offer them a stronger material.

As a result of this test Monsanto has been able to develop film resins of outstanding toughness. It can also be extremely valuable to extruders by helping them...

1. Control film production to maximum toughness levels.
2. Select the most suitable resins for shock resistance.
3. Measure the influence of extrusion conditions on film strength.

Other Monsanto tests developed to assure you the best resin for the job compare film for tear resistance, abrasion resistance and transparency—all based on actual in-use conditions. Monsanto polyethylene is supplied for molding, film, pipe, wire coating extrusion-lamination coatings and blow-molding.

*Write for data sheets and informative literature:*

Monsanto Chemical Company, Plastics Division, Room 664, Springfield 2, Mass.

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# The Plastiscope

materials were formerly used to solve a temperature problem during manufacture of a finished product that does not require Class H rating.

A companion product, Isobestos, consists of the same coating on an asbestos base.

**Close tolerances for laminates**

Two exceptional 400-ton presses, built to order, have been installed in the new plant of The Glastic Corp., 4321 Glenridge Rd., Cleveland 21, Ohio. The purpose is to achieve closer tolerances in flat sheet molding of fibrous glass-reinforced plastic. The company reports that it can now produce material with a ±1/64-in. accuracy by length and width, and down to ±0.005 in. thickness.

Glastic asserts that sheets made to these tolerances will eliminate the costly necessity for the customer to order 1 in. more than needed in both directions on phenolic sheets and accepting as much as 2 in. more. These savings can amount to as high as 10% of the cost of 36- by 36-in. sheets. The precision-sized sheets will be of particular benefit to the electrical industry when phenolic or polyester laminates are required.

**Epoxy hardeners**

Commercial quantities of two new liquid epoxy hardeners—Dion RP-7 and Dion RP-22—based on meta-phenylene diamine and 4,4' methylene dianiline, respectively, have been announced by Chemical Process Co., Redwood City, Calif.

The company states that the hardeners are liquid at room temperature and thus offer convenience of application, compared with solid catalysts which must be heated first. They can be used as general-purpose epoxy catalysts, although they are particularly effective when high-temperature resistance in a cured product is desired.

Literature giving directions for use, indicated pot life, physical properties of cured laminates, and recommendations for storage may be obtained from the company.

Another epoxy hardener has been announced by Furane Plastics, Inc., 4516 Brazil St., Los Angeles, Calif. Called Promoter D-40, the hardener is of a mild amine type considered to be relatively non-toxic because of its high boiling point and low order of reactivity. According to the manufacturer, masses up to 40 lb. of clear resin have been prepared with no difficulty. These represent the largest clear castings of epoxy resins which have been produced in a single pour. Circuits and other devices which require resin masses of 1 to 5 lb. may be cured at temperatures between 140 to 160° F.

**Polyethylene in bulk**

A new bulk-shipment plan to deliver Tenite polyethylene spherical pellets directly into customers' storage bins has been announced by Eastman Chemical Products, Inc., 260 Madison Ave., New York 16, N. Y. This service offers savings in material handling and may also reduce the amount of floor space required for storage. The shipments are made by truck in airtight compartments.

The customer must have storage bins to take advantage of the bulk-shipment service. A capacity of 1000 cu. ft. (15 tons) each is suggested. The bins may be in either outdoor or indoor storage areas, but must be located so that a delivery line from the unloading area is not longer than 100 feet. The delivery line itself should be 6-in. light gage aluminum and should have a length of flexible hose for making connections with the truck.

The polyethylene is unloaded through the line, directly into the bins, by means of self-contained pneumatic facilities in the shipment unit. The spherical shape of the pellets not only enables them to flow freely, but cuts down dust. Carrying automatic handling a step further, the customer may in turn feed the pellets straight from storage bin to processing equipment, either by gravity or by mechanical means.

The new bulk-shipment service is now available east of the Mississippi, except to Florida, and to Minnesota, Arkansas, and Texas.

**Acrylic paint**

Sales for acrylic paint doubled in volume during 1955 and the number of companies producing acrylic paints also doubled, according to a report presented at the Case Institute of Technology by Gerould Allyn, Rohm & Haas Co., Philadelphia, Pa. Acrylic latex was first put on the market by Rohm & Haas in January 1953.

Mr. Allyn stated that modern water paints are only eight years old, but annual production has already passed the 50 million-gal. mark. Figures on total sales achieved by each of the latex types—butadiene, styrene, polyvinyl acetate, and acrylic—have not been released by the producers, but it is known that production of all water-vehicle paints has been increasing at the rate of at least 5 million gal. a year for the past five years.

Acrylic paints have figured prominently in this expansion, according to Mr. Allyn, who reported that over 300 companies are now producing water paints based on acrylic emulsions—twice the number in the field at the beginning of 1955.

**Destaticization**

A chemical developed by The J. E. Doyle Co. in cooperation with leading chemical laboratories is guaranteed by the company to stop the accumulation of static electricity due to friction in plastics processing equipment, auto seat covers, printing presses, and the like. The product is packaged in handy self-spraying cans.

The firm states that the chemical contains no mineral oils, radium, mercury, or harmful acids, and is non-toxic. It can be applied as liberally as needed, but the lightest of applications is effective. Continued use is said to be cumulative, reducing the fre-

quency of static evidence and eventually creating completely static-free conditions.

The product is also available in bulk for swabbing, wiping, spraying with hand pump or hand power sprays, or by fogging. The 12-oz. cans sell for $3.00 each.

Additional information may be obtained by writing to Dept. P, Statikil Div., The J. E. Doyle Co., 1220 W. 6th St., Cleveland 13, Ohio.

Another development in destaticization comes from Alframine Corp., 4731 E. 52nd Dr., Los Angeles 22, Calif., which states that the addition of its Electrosol D or M to polyethylene pellets, before processing, will help to prevent static build-up in the finished product.

According to company literature, the addition of from ½ to 1½% of its material to polyethylene powder or pellets will prevent sheets from clinging together, allow bags to open up easily for packaging, and retard dust collection. In addition, the material is said to give good mold release, better elasticity, increase of comeback, and greater clarity.

### Research conferences

The 1956 Gordon Research Conferences of the American Association for the Advancement of Science will be held in New Hampshire from June 11 to August 31 at Colby Junior College, New London; New Hampton School, New Hampton; and Kimball Union Academy, Meriden.

The Conferences were established to stimulate research in universities, research foundations, and industrial laboratories. They consist of scheduled lectures and free discussion groups. The week-long meetings are held in the morning and in the evening, Monday through Friday. Afternoons are available for recreation, reading, or participating in discussion groups as the individual desires.

In order to protect individual rights and to promote discussion, no information presented is to be used without specific authorization of the individual making the contribution. No publications are prepared as emanating from the Conferences.

Among the subjects of some of the week-long Conferences will be polymers, corrosion, organic coatings, ion exchange, and elastomers. A famous guest at the latter discussion, to be held from July 30 to August 3, will be G. Natta who will discuss "Synthesis by Anionic Polymerization of New Elastomers and Unsaturated Crystalline Polymers."

Request for attendance at the Conferences or for any additional information should be addressed to W. George Parks, director, Dept. of Chemistry, University of Rhode Island, Kingston, R. I. From June 11 to August 31, mail should be addressed to Colby Junior College, New London, N. H.

### Custom adhesives and coatings

Now available from Merad Laboratories, Inc., Indianapolis, Ind., are custom solvent-release synthetic resin adhesive formulations that, it is claimed, won't shrink or embrittle and in many cases are stronger than the materials they bond. No baking or catalysts are needed.

The new cements are produced to manufacturers' requirements for bonding electrical components, wood, plastics, metals, fabric, and glass. Application may be made by brushing, dipping, and spraying (squeeze bottle or air pressure).

The company also has special formulations for gluing nylon, polyethylene, Teflon, Kel-F, polystyrene, and other materials.

### Epoxy for cable splicing

A hard-setting epoxy compound, called Thoxene Clamp-Coat, has been developed by Woodmont Products, Inc., Huntingdon Valley, Pa., which permits rapid field insulation and weatherproofing of electrical cable splices. The material is also used as a sealant for gas lines.

Packaged in a compartmented polyethylene container, Thoxene Clamp-Coat is ready to use as soon as its two separate components have been thoroughly mixed. By covering the cable splice with the activated formulation and allowing a setting time of 2½ to 3 hr., depending on the ambient air temperature, a weatherproof, abrasion-resistant coating with high electrical insulation is achieved.

### Wall covering price cut

List prices on textured three-dimensional wall covering, vacuum formed from vinyl sheeting, have been reduced as much as 22% by National Vacuum Molding Corp., 923 Old Nepperhan Ave., Yonkers, N. Y. The 22% cut was announced for the white Decro-Wall material (Rembrandt white patterns, formerly retailing at 63¢ per sq. ft., now sell for 49¢); wall coverings in red and other colors were reduced 10 percent.

Herbert Zipkin, president, states that volume sales, far greater than expected when Decro-Wall was placed on the market in May 1955, have made possible the installation of new mass-production plant equipment.

### More laminating equipment

Increasing demand for more printing and laminating equipment in the plastics industry has encouraged Lembo Machine Works, Inc., Paterson, N. J., to plan building an additional plant in Newburgh, N. Y. About 95% of Lembo's production is devoted to equipment for the plastics industry.

Lembo has been primarily a producer of printing, take-off, and other equipment used in converting vinyl films. The company claims to have built the first printing press used exclusively for vinyl film; most of the early machines were converted textile printing presses.

One of the firm's specialties is equipment for laminating vinyl to fabric or vinyl to vinyl without use of an adhesive. Mylar film

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can also be embossed and laminated to other materials with Lembo equipment. Only two of these new laminating installations are now in operation, but others are on order.

Such activities point up the fact that laminating is today one of the fastest growing sections of the industry. Several laminators have had plants operating seven days a week around the clock since August.

**Dispersed carbon black**

Price reductions on processing charges for dispersing carbon black and pigments in polyethylene have been announced by Acheson Dispersed Pigments Co., a unit of Acheson Industries, Inc., The Morris Bldg., Philadelphia 2, Pa.

Acheson, which also has dispersed pigments plants in Orange, Texas, and Delaware, Ohio, attributes the price reductions to three factors: 1) Increased volume of dispersed carbon black and pigments for polyethylene manufacturers; 2) installation of new equipment for more efficient methods of dispersing; and 3) confidence in the growth of polyethylene.

**New elastomeric adhesive**

Availability of a new elastomeric-type adhesive for contact and hot-bonding of a wide variety of porous and non-porous surfaces has been announced by Adhesives & Coatings Div., Minnesota Mining & Mfg. Co., 411 Piquette Ave., Detroit 2, Mich. Called EC-1357, the adhesive can be used in bonding metal frames to plywood, aluminum sheets to aluminum channels, and decorative plastic laminates to metal counter and table tops. In sandwich constructions it can bond aluminum sheets to impregnated kraft paper honeycomb.

After surfaces of parts to be bonded are chemically cleaned, the adhesive is applied with a hand roller or by spraying. It is then dried with infra-red heat. The parts can be hand assembled and bonded while hot by one pass through a pressure roll. Air-drying methods can be used in conjunction with hand rollers for low-production bonding.

**Reinforced packaging**

A technical conference on reinforced plastics for packaging and materials handling was held on March 27 in the auditorium of the Department of Commerce Bldg., Washington, D. C.

The conference was sponsored by the Containers and Packaging Div., Business and Defense Services Administration, United States Department of Commerce, in cooperation with The Society of the Plastics Industry, Inc. and The American Society of Mechanical Engineers.

**Plastics Fair**

The Upper Midwest Section of the Society of Plastics Engineers, Inc. will sponsor a Plastics Fair at the Prom Ballroom in Minneapolis, Minn., on May 21 from 5:00 to 10:00 P.M. Plastics manufacturers and processors in the upper midwest are invited to submit samples.

The Fair will be open to exhibitors and their guests, S.P.E. members, their wives and guests, as well as the press and TV reporters.

Additional information may be obtained from Erwin Ulrich, Minnesota Mining & Mfg. Co., St. Paul, Minn., or Jerome Formo, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

**A laminator for Texas**

Production operations have begun in the first Texas plant to be set up to manufacture high-pressure decorative laminates, according to Ralph Wilson, president and general manager of Ralph Wilson Plastics, Inc., Temple, Texas. Mr. Wilson also reports that the modern equipment in the new plant will produce the largest sheet of high-pressure laminate in the industry. Distribution of the material for both commercial and household uses will be set up on a regional basis in Texas.

The new structure, which represents a $1 million investment, occupies an area of 50,000 sq. ft. on an 8-acre site in Temple. The newly formed corporation will employ 150 persons and expects to produce approximately 1½ million ft. of high-pressure laminate per month.

**Sheet material**

A new line of high-impact styrene and polyethylene sheets has been introduced by Lurie Plastics, Inc., 1913 Boulevard, Colonial Heights, Va., for the vacuum forming, packaging, and display markets. The high-impact styrene sheet is tradenamed Luraplast HS and the polyethylene sheet, Luraplast P. The company claims to be one of the first to come out with a polyethylene sheet in widths up to 48 in. and gages from 0.015 to 0.125 inch.

In the high-impact styrene sheet, Lurie has developed a three-dimensional gold or silver effect, which is referred to as Williamsburg and Colonial finishes. This material is suggested for the refrigeration industry, picture frame industry, and display houses.

**New extruded film**

Polyethylene flat tubing in widths from 3 to 5 in. is now being marketed by M. R. Gerow & Associates, Clinton Rd., Caldwell Township, N. J. Because production is based on a new method of extrusion under a patent recently granted Mr. Gerow, the films are being offered at considerable savings. Films made under the Gerow patent are claimed to exhibit good slip and clarity.

At the present time only untreated films are available.

**Correction**

Accidental omission of the name of Cordo Chemical Corp., Norwalk, Conn., as suppliers of fibrous glass-epoxy resin repair kits in the article "Patch it With Plastics," MODERN PLASTICS 33 p. 98 (Dec. 1955), has been

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called to the attention of MODERN PLASTICS' editors in a letter from that firm. Cordo claims to be the first company to have worked with the United States Navy in developing the damage repair kit used by the Navy.

## Plasticizer news

**Cabot plasticizer.** Commercial production of Cabflex HS-10, a low volatility phthalate plasticizer with good processing characteristics, has been announced by Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass. The plasticizer, an alkyl aryl phthalate developed by Cabot Research & Development Laboratories, is asserted to have a lower volatility than any other available phthalate plasticizer—one-half that of didecyl phthalate. It is claimed to have the same processing characteristics and vinyl resin compatibility found in D.O.P.

Cabflex HS-10 has been specifically developed to fill a need for a monomeric plasticizer having high stability and permanence, suitable for use in applications where products are subjected to above normal atmospheric conditions. It requires no anti-oxidant, electrical properties are claimed to be superior to D.O.P., and long-term aging tests in an air circulating oven at high temperatures have demonstrated its resistance to oxidation and heat breakdown.

**New name.** Conoco H-300 is the new name of the secondary plasticizer formerly known as Conoco H-340, according to an announcement by Continental Oil Co., 630 Fifth Ave., New York 20, N. Y. Chemical qualities and manufacturing specifications remain the same.

**Barrett Div. plasticizer.** Volume production of a new low-temperature plasticizer for vinyl products, designated as Elastex 20-A, has been announced by Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

According to J. E. Shand, assistant sales manager, the new product (di-isodecyl adipate), not only gives vinyl formulations excellent performance at low temperatures, but also provides relatively low volatility and good resistance to heat degradation.

**Price reduction.** A price reduction to 55¢ a lb. (f.o.b. Newark, N. J.) on Celluflex CEF, a fire-resistant plasticizer, has been announced by Celanese Corp. of America's Chemical Div.

## Pipe notes

**Cement for piping.** A new solvent cement for joining P.V.C. pipe fittings and flanges has been developed by Tube Turns Plastics, Inc., 2929 Magazine St., Louisville 11, Ky. It is claimed that the cement makes possible a joint as strong as or stronger than the pipe itself. An ordinary paint brush usually serves as the applicator. A cemented joint can be handled after 1 hr. and reaches working strength in 48 hours.

Recently, a Texas oil company laid a 3800-ft. P.V.C. line to investigate the paraffin inhibiting properties of the material. It consisted of 30-ft. lengths of 3-in. Schedule 40 pipe and Schedule 80 fittings, both of normal-impact P.V.C. A three-man crew with no previous experience in making P.V.C. installations completed the job in 1 hr. and 45 minutes. When a carbon steel screwed-joint line of the same dimensions was laid, the same crew required 4 hr. and 30 min. to finish the assignment.

**P.V.C. pipe.** Rigid, non-plasticized vinyl chloride pipe, tradenamed Ryertex-Omicron, will be marketed by Joseph T. Ryerson & Son, Inc., Chicago 80, Ill. Pipe fittings and valves of the same material are also available. Ryertex-Omicron P.V.C. pipe will be supplied in Schedule 40 and Schedule 80 pipe sizes.

The Ryerson firm, which operates 16 steel service plants in the United States, first became identified with industrial plastics in 1932 when its Ryertex laminated plastic was developed, principally for use as a bearing material. The growth of this division prompted the addition of other plastics, of which plastic pipe is the most recent.

**Corning Glass Works pipe.** New corrosion-resistant polyvinyl chloride pipe was recently introduced to the chemical industry by Corning Glass Works, Corning, N. Y. The Corning brand P.V.C. pipe and fittings are designed for low-cost conveying of corrosive fluids at moderate temperatures (140° F. and under).

The rigid, unplasticized pipe will be available in 10-ft. or custom-ordered 20-ft. lengths of American Standard 80 threaded pipe, with inside diameters ranging from approximately ½ to 4 inches. A feature of the Corning line will be P.V.C. valves made by Lunkenheimer Co.

All Corning P.V.C. pipe and fittings have a maximum recommended working temperature of 140° F., with a maximum working pressure of 125 p.s.i. at room temperature.

The company also announces that Pyrex brand armored glass pipe will feature a new type of fibrous glass protective coating. A seamless sleeve of fibrous glass, fitted snugly over the glass pipe and impregnated with polyester, forms an armor designed to protect the pipe against rough handling and to carry the same load as the pipe in case of glass failure.

The fibrous glass jacket is nonflammable and is cut to fit the length of the pipe. It is corrosion resistant, unaffected by weather moisture or rodents, and has a maximum operating temperature of 300° F.

**New entry.** Orangeburg Mfg. Co., Inc., Orangeburg, N. Y., and Newark, Calif., a leading manufacturer of electrical fiber conduit and bituminized-fiber sewer pipe, has started construction of a plastic

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**LEFT:** 27-INCH BLOWER for expelling corrosive air, fumes and gases—made of SEILON by INDUSTRIAL PLASTIC FABRICATORS, INC., Norwood, Massachusetts. The steel drive shaft is completely insulated with SEILON to the main bearing on the pedestal. The inherent anti-corrosive qualities of SEILON assure long life where corrosion is a factor.

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standard sheet size: 48″ x 96″ . . . high and normal impact P.V.C. for corrosion applications . . . decorative P.V.C. panels . . . heavy-gauge, formable high-impact P.V.C.

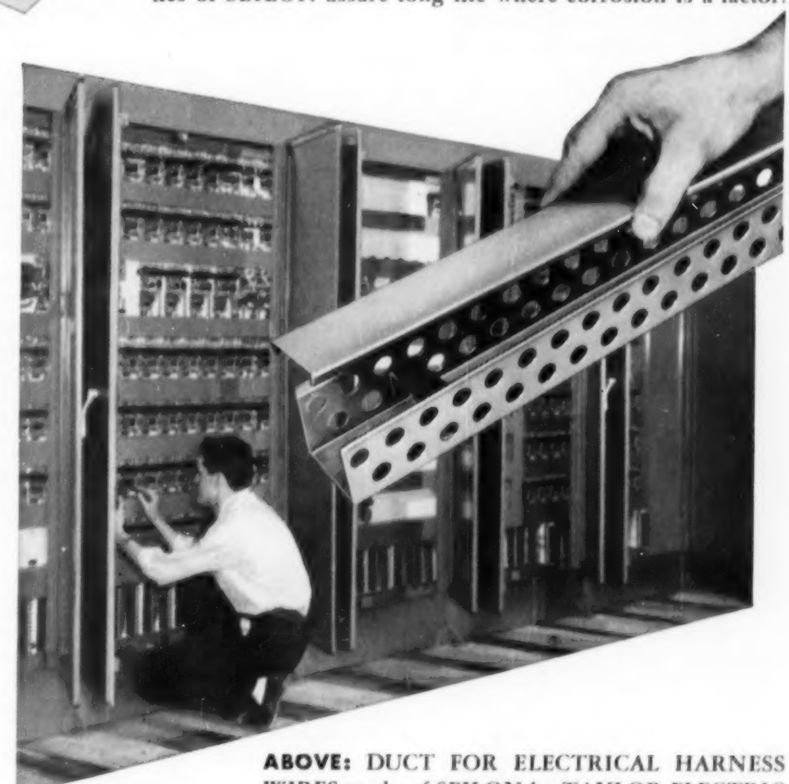
### CALENDERED SHEETS

widths up to 51½″ . . . superior high-impact polystyrene . . . normal and high-impact P.V.C. for corrosion resistance . . . and formable high-impact P.V.C. for vacuum forming.

### EXTRUDED SHEETS

widths up to 48″ . . . high-impact styrene.

Seiberling Plastics Division is adaptable to customers' requests. We will welcome the opportunity to consult with you on individual specifications of properties, gauges, colors and finishes for your products. Delivery is prompt—can be made in 10 days to two weeks.



**ABOVE:** DUCT FOR ELECTRICAL HARNESS WIRES made of SEILON by TAYLOR ELECTRIC INC., 154 Dale, DETROIT 23, MICHIGAN. SEILON is ideally suited for this job which makes wiring installation three times faster. It protects the wires from fire, chemical action and abrasion. SEILON RIGID SHEETING can be formed into many shapes. It has high impact strength, high dielectric qualities, is easily formed. Perhaps the versatile qualities of SEILON can help you solve your production or cost problems.


*Plastics Division* **SEIBERLING RUBBER COMPANY**

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pipe plant adjoining its present plant in Orangeburg. It is scheduled for completion in July.

The new plastic pipe will be marketed through existing Orangeburg distributor firms and will in no way compete with present Orangeburg Mfg. Co.'s products.

## Expansion

**Monsanto Chemical Co.'s Plastics Div.**, Springfield, Mass., announces the installation of a model decorative and industrial laminating laboratory as part of an increased effort to develop and perfect uses for the company's melamine and phenolic laminating resins.

Monsanto states that the expansion program is in anticipation of the introduction of new resins for specialty uses in laminates intended for the furniture, construction, and electronic industries.

**St. Regis Paper Co.** is opening a thermoplastics laboratory in Richmond, Ind., where it has plants for injection molding and vacuum forming. The new laboratory will be engaged in the development of new processes, applications, materials, and equipment for use in thermoplastics manufacture.

**Paul E. Schmidt**, chief thermoplastics engineer, will head the new laboratory. He formerly served with the Panelyte Div.'s Advanced Engineering Dept.

**The Electric Storage Battery Co.**, Philadelphia, Pa., has purchased **Jessall Plastics, Inc.**, Kensington, Conn.

Officers elected for the acquired company are **R. R. Zisette** as a director, vice president, and general manager and **R. S. Jesionowski** as a vice president and director. Until Mr. Zisette's new appointment, virtually his entire business career was with SKF Industries, Inc., where as vice president he had full responsibility for sales and public relations. Mr. Jesionowski was at one time assistant to the research director of Plax Corp. In 1946, he founded his own company, Jessall Plastics, Inc., which was purchased by Electric Storage Battery. In his new post, Mr. Jesionowski will supervise all manufacturing and development activities.

Electric Storage Battery also announces that **Thomas E. Wallis** has been named assistant to the general manager of its Stokes Molded Products Div., Trenton, N. J.

**Resistoflex Corp.**, formerly of Belleville, N. J., is now located at Roseland, N. J., where its new plant and research facilities double the firm's former capacity. A substantial addition to the new plant is already under construction for the manufacture of Fluoroflex-T R500 hose, used extensively in critical high-temperature applications in the aircraft field.

Resistoflex originated and claims to be the largest producer of aircraft hose assemblies, using Du Pont's Teflon. Similar hose assemblies are used for nuclear reactors, guided missiles, high-pressure hydraulic systems, and other industrial hot spots.

**Precise Products Corp.** announces plans to move into a new plant on Blue River Rd., Racine, Wis. The expanded facilities will permit a 100% production increase in the company's line of grinder mills, machine tools, and accessories.

Precise's experience goes back to 1882, when the company was founded as Firma A. Schumann in Düsseldorf, Germany.

**M & L Plastic Corp.**, Easthampton, Mass., has purchased the building which it has been occupying for the past nine years and has added an area of 6500 sq. feet.

The company also announces the addition of a 12-oz. injection molding machine to its present four 8-oz. machines, as well as hot stamping equipment. This expansion will permit M & L to increase production of its line of molded plastic containers.

**The Electric Auto-Lite Co.'s Wire and Cable Div.** announces that it is currently engaged in a million-dollar expansion program at its Port Huron, Mich., plant to meet the increased demand for wire and cable. Production of Auto-Lite high-temperature aircraft wire will triple and production of plastic-coated wires will double in 1956.

**Leathertone, Inc.**, 260 Tremont St., Boston 16, Mass., has completed installation of additional equipment which will increase the firm's production capacity over 300 percent. The company can now produce laminated sheets measuring 24 by 54 in. and by the end of the year will produce sheets measuring 48 by 96 inches. The former maximum size was 21½ by 41 inches.

For 32 years Leathertone has produced thermoplastic and thermosetting decorative laminates for such items as jewelry, sunglasses, handbags, lampshades, etc. The firm specializes in the use of fancy woven fabrics, laces, feathers, and metallics that are used for inserts between laminated sheets. Leathertone emphasizes particularly its use of metallic acetate and Mylar fibers which it uses in fabric inserts.

**H. I. Thompson Fiber Glass Co.**, manufacturer of high-temperature insulation, has completed a new plant for its Reinforced Plastics Div. at 1611 W. Florence Ave., Inglewood, Calif.

The new structure will triple the capacity of the division which produces radomes, ducts, scoops, support assemblies, and other reinforced plastics parts.

**Plas-Ties Co.** has moved into its new plant at Santa Ana, Calif., occupying an area of approximately 10,000 sq. feet.

The company manufactures Plas-Ties, the vinyl-covered wire ties used as closures for plastic bags, for tying plants, and many industrial applications. Other

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products manufactured by Plas-Ties include paper-covered wire ties, which are laminated with polyethylene and used in the produce field for bunching vegetables, and the Plas-Tie Matic bag closing machine, which applies bag closures to film bags.

**Jerry Bower** is general manager of the company.

**Richmond Plastics Ltd.** has doubled its plant area by the purchase of a one-story building in Richmond, Que. The company, a subsidiary of **National Plastic Products Co.**, Odenton, Md., produces saran monofilaments for the Canadian textile industry.

**Stauffer Chemical Co.** has increased the size of its Molded Products Div. in Vernon (Los Angeles), Calif., by 15,000 sq. feet. The division, formerly known as the Western-Pacific Container Div., manufactures hard rubber and plastic battery cases and parts, as well as molded products for home and industry.

**Detroit Mold Engineering Co.** announces that the company has doubled manufacturing facilities at its Hillside, N. J., plant, installed additional machinery at its Detroit, Mich., plant, and improved warehouse facilities.

**Correction**

**Fiberfil Corp.** In the February issue of the Plastiscope, it was reported that Fiberfil Corp., Warsaw, Ind., could produce Fiberfil styrene compounds at a rate of 400 million lb. yearly. That would be a nice business, but it was a slight exaggeration. The correct figure is 4 million pounds.

## Company notes

**Hercules Powder Co., Inc.: Dr. Richard E. Chaddock** will head the newly created post of director of development of Hercules' Virginia Cellulose Dept. **Dr. William G. Kinsinger** succeeds Dr. Chaddock as manager of the Sales Research Div.

**Pittsburgh Coke & Chemical Co.**, Pittsburgh, Pa., has consolidated its Coal Chemicals and Plasticizer Divs. into an Industrial Chemicals Div., with **Henry Avery** as general manager; **Duncan J. MacLennan** as assistant general manager; and **John L. Frothingham** as sales manager. **Alfred J. Oxenham** will manage the division's product development group and **Homer W. Fry** will serve as superintendent of production.

**United States Plywood Corp.**, 55 W. 44th St., New York, N. Y., has established an Engineering Sales Dept. to coordinate new product development and sales under the supervision of **Raymond C. Platow**, the company's chief materials engineer. Emphasis will be on specialty materials such as industrial adhesives, metal-faced plywood, sandwich construction panels, hard board made from waste wood, and premachined plywoods.

**F. J. Stokes Machine Co., Inc.**, Philadelphia 20, Pa., has established a Canadian subsidiary, **F. J. Stokes Co. of Canada, Ltd**, 27 Wellington St., E., Toronto, Ont.

**J. William Robinson**, who has been manager of Stokes' Canadian sales office in Montreal since it was opened in April 1953, will continue in charge of all Stokes' Canadian operations under the new company. **Charles V. Nicholson**, who formerly held the position of manager of the International Div., has been named general manager of product sales.

**Hooker Electrochemical Co.** has announced that **John F. Snyder, Jr.**, formerly superintendent of the new $5 million phenolic molding compounds plant of the **Durez Plastics Div.** in Kenton, Ohio, is now works manager. He will report to **Dr. Jay C. Searer**, division production manager. Mr. Snyder is the son of **John F. Snyder, Sr.**, a vice president of Hooker. **Dr. Nicodemus E. Boyer**, chemist, has joined the exploratory organic research group of Hooker's Research and Development Dept. at Niagara Falls, N. Y.

**Eastman Chemical Products, Inc.: James C. White**, formerly president, is now chairman of the board; **William S. Vaughn**, formerly first vice president, is now president and a director. Mr. White continues as president and Mr. Vaughn as first vice president of Tennessee Eastman Co. and Texas Eastman Co., manufacturing divisions of Eastman Kodak Co. Eastman Chemical Products markets the products of these divisions.

**Interchemical Corp.: Harris S. Woodman**, formerly division president of the **Wadsworth & Woodman Div.**, Winthrop, Me., is now division chairman. **Floyd Anderson**, formerly plant manager and division controller with Wadsworth & Woodman for 10 years, is now general manager. This Interchemical unit produces vinyl-coated fabrics. Mr. Woodman will continue as an active consultant for Wadsworth & Woodman and will assume a similar function for Interchemical's **Cotan Div.** at Newark, N. J., also a coated fabrics producer.

**The M. W. Kellogg Co.**, Jersey City, N. J., has appointed **Saint-Gobain Co.** as its exclusive agent in France and Spain for the sale of its fluorocarbon products.

Saint-Gobain also produces silicones in association with Dow Corning Corp., monomeric vinyl chloride and vinyl polymers under its own process, and imports a number of United States products.

**Reichhold Chemicals, Inc.: Henry H. Reichhold** is chairman of newly formed executive committee. **Dr. Stefan H. Baum** is executive vice president and **Herbert W. Mason, Jr.**, vice president and general manager. Dr. Baum, a director of the firm, joined RCI in 1933 and was named production supervisor

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. . this molded plastic impeller, perfectly balanced for high speed rotation during washing, rinsing, and drying cycles, a vital part . .

. . of this Hotpoint Dishwasher

. . this molded plastic thermostat switch, an important part . . of this Hotpoint Range . . and of this Hotpoint automatic electric clothes dryer . .

Richardson know-how, based on thousands of jobs and years of experience in plastics, produced both the intricate Bakelite molded thermostat switch and the sturdy, streamlined impeller shown above. Richardson engineers, specialists in both molded and laminated plastics, will welcome the opportunity to discuss your requirements.

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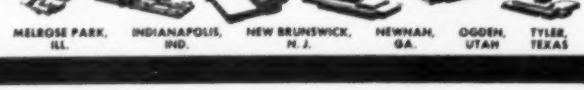

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# The Plastiscope

a year later. Mr. Mason, also a director, joined the company 20 years ago and has been administrative vice president for the past two years.

**General Electric Co.: Dr. George E. McCullough** is manager of process development of the Chemical Development Dept. at Pittsfield, Mass., and **Walter J. Dugan** is manager of sales development, Marketing Section, Silicone Products Dept., at Waterford, N. Y.

**Pyramid Products, Inc.**, Cleveland, Ohio, is now affiliated with **R. D. Cistone & Associates**, 210 Heights-Rockefeller Bldg., Cleveland 18, Ohio. Facilities include injection machines ranging from 4 to 30 ounces. A complete engineering service is offered to users of plastic parts and products.

**Glebar Co.**, producer of centerless grinding equipment for the plastics industry, has moved to a new plant at Franklin Lakes, N. J.

**Tensolite Insulated Wire Co., Inc.**, 198 Main St., Tarrytown, N. Y., announces the availability of Tensolon Teflon spaghetti tubing for high-temperature electronic and electrical wiring applications.

**Wagner Mfg. Co., Inc.**, 350 W. Adams St., Jackson, Mo., has entered the field of custom molding of thermosetting materials.

## Personal

**George W. Whitehead** has been elected vice president of plastic machinery sales for **Improved Machinery Inc.**, Nashua, N. H. Mr. Whitehead joined the company in 1944 and has been sales manager of the Plastics Div. since 1949.

**Martin J. Tierney**, formerly assistant commercial development manager of **Naugatuck Chemical Div., United States Rubber Co.**, Naugatuck, Conn., is now commercial development manager of the division. He succeeds **Clayton Ruebensaal** who has become director of commercial planning of Texas-U. S. Chemical Co., jointly owned by The Texas Co. and U. S. Rubber Co.

**John Neuman**, formerly of Nu-Manufacturing Co., Chicago, Ill., is now representative of **Guy P. Harvey & Son Corp.**, Leominster, Mass., and will handle the company's injection presses and other plastics processing equipment in Illinois and Indiana.

**Merle W. Kremer** is now assistant general manager of the Parts Div. of **Sylvania Electric Products, Inc.**, Warren, Pa., which manufactures plastic closures as well as many other products.

**Stewart M. Wood** succeeds Herman Bauer as sales manager of **Ball & Jewell, Inc.**, 24 Franklin St., Brooklyn 22, N. Y.

**Erwin V. Kistner**, has been named New York sales engineer of **Arthur Colton Co.**, Detroit, Mich. His headquarters will be at the company's New York office, 303 Fifth Ave., and he will handle Colton machinery sales in southern New Jersey, eastern Maryland, Delaware, eastern Pennsylvania, and Washington, D. C.

**Thomas J. LaBounty** is now vice president of **Bee Chemical Co.** and its subsidiary, **Logo, Inc.**, 13799 S. Avenue O, Chicago 33, Ill.

**Steve T. Lucas**, formerly a buyer for Mine Safety Appliance Co., Pittsburgh, Pa., is now on the purchasing staff of **General Molds & Plastics Corp.**, 1435 Western Ave., Pittsburgh 33, Pa. The firm manufactures Andy Gard toys.

**Richard S. Light** is now vice president in charge of manufacturing of **Plax Corp.**, Hartford, Conn. Mr. Light, who joined the company last year as general factory manager, previously served with Snow Crop Div. of Clinton Foods, Inc. and as manufacturing manager in charge of operations at Lever Brothers.

**Robert C. Davenport**, formerly vice president and sales manager of Gregstrom Corp., has joined **Plastic Products Corp.**, Bedford Heights, Ohio, as vice president and general manager of its newly formed Thermoplastic Sheet Forming Div.

**R. C. Seanor**, now vice president in charge of engineering of **Adamson United Co.**, Akron Ohio, has been with the company since 1946 engaged in designing and building machinery for the plastics and rubber industries.

**Dr. Gerald R. Barrett**, now on the research staff at the laboratory of **Raffi and Swanson, Inc.**, Wilmington, Mass., will be engaged in development of coatings based on polyurethane and other new polymers. Dr. Barrett was for many years with Monsanto Chemical Co. as research group leader on the synthesis of coating and textile treatment resins.

**William Murphy**, formerly assistant production manager, is now production manager of **Bolta Products**, Lawrence, Mass. Mr. Murphy originated Bolta's controlled lamination process for adhering vinyl sheeting to a fabric backing. He was formerly manager of the Plastics Div. of Goodall-Sanford, Inc., Reading, Mass.

**Richard Firstenberg** is now sales manager of **First Machinery Corp.'s Falcon Mfg. Div.**, 209 Tenth St., Brooklyn 15, N. Y. The division has started production of ribbon blenders, tumbling batch mixers, stainless steel kettles, tanks, rotary cutters, and portable agitators.

**Dr. Kurt Frisch**, now manager of polymer research of **Wyandotte Chemicals Corp.**, Wyandotte, Mich., will supervise and coordinate research work on development and application of synthetic resins based on intermediates

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Rutile types of TITANOX white titanium dioxide pigments are universally acceptable for most types of plastics—whether extruded, molded, sheet, or film-coated. For white and light tinted stocks, TITANOX-RA provides maximum whiteness, brightness and opacity. For heavily loaded stocks where the high opacity of "pure" titanium dioxide is not needed, TITANOX-RCHT or TITANOX-C-50 may be used.

But whatever the use, no other whitening agent gives plastic products the color and sparkle—the eye-catching appearance—that TITANOX does. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Atlanta 5; Boston 6; Chicago 3; Cleveland 15; Houston 2; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 14, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

*Titanium Pigment Corporation is a subsidiary of National Lead Company*

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produced by the company. Dr. Frisch was formerly associated with E. F. Houghton & Co. and with General Electric Co.'s Chemical Div. engaged in polymer chemistry.

**James M. Klaasse** has been appointed chief engineer of **American Instrument Co., Inc.,** Silver Spring, Md., manufacturer of scientific laboratory apparatus.

**W. L. Fluke** is now field sales manager of **Barber-Webb Co.,** 3864 Santa Fe Ave., Los Angeles 58, Calif. Barber-Webb is an applicator of plastic linings and coatings for industrial equipment and has recently introduced several rigid plastic pipe and structural sheet applications.

**John A. Rinek** is now general sales manager of **Heli-Coil Corp.,** Danbury, Conn., manufacturer of wire screw thread inserts.

**Raymond F. Gerow,** now project engineer of **United States Testing Co., Inc.,** 1415 Park Ave., Hoboken, N. J., will specialize in plastics at the company's Materials Engineering Dept. Mr. Gerow was formerly process engineer of De-Laval Separator Co.

**Norman E. Hathaway,** now in the newly created post of coordinator of marketing of **Oronite Chemical Co.,** 200 Bush St., San Francisco, Calif., joined Oronite, a subsidiary of **Standard Oil Co. of California,** in 1954 as western sales manager. He was formerly director of the Chemical and Rubber Div., Business and Defense Services Administration, Dept. of Commerce, and general sales manager of industrial chemicals of Davison Chemical Co.

**George H. Taft,** formerly vice president of Deecy Products Co., has established a consultant service in Concord, Mass., to assist management in the plastics and chemical industries. Prior to his association with Deecy, Mr. Taft was engaged in research and development at B. F. Goodrich Co.

**Alvin W. Keeshan,** now vice president and chief engineer of **Modern Engraving & Machine Co.,** Hillside 5, N. J., was formerly manager and chief engineer of American Type Founders, Elizabeth, N. J.

**Fritz J. Nagel,** recently appointed vice president of **Polymer Processes, Inc.,** a subsidiary of **The Polymer Corp.,** Reading, Pa., formerly served with Congoleum-Nairn, Inc. and several plastics companies.

**Dale Moore** is the new vice president of sales of **Kimball Mfg. Co.,** San Francisco 7, Calif. Kimball products include fibrous glass water skis, decorative accessories, and poster panel moldings.

**Gilbert D'Andrea,** new director of design of **Bassons Industries Corp.,** 1432 West Farms Rd., New York 60, N. Y., joined the company five years ago as an industrial designer. Many of his designs have been incorporated in the new Air Force crash helmets.

**Robert F. Gager,** formerly director of research, has been elected vice president of research of **Synco Resins, Inc.,** Bethel, Conn.

**John L. Patterson** is the manager of the newly established Sales Promotion Dept. of the Plastics Div. of **Celanese Corp. of America,** 180 Madison Ave., New York 16, N. Y.

**E. L. Holloway,** formerly Midwest district sales manager, has been promoted to direct sales manager of **Olin Mathieson Chemical Corp.'s Film Div.,** 460 Park Ave., New York 22, N. Y.

### Deceased

**DeForest Lott,** 57, chief development engineer of the **Textileather Div., The General Tire & Rubber Co.,** Toledo, Ohio, died of a heart attack on February 11. He had been with Textileather for 33 years.

**Irving G. Felsenthal,** 68, chairman and president of **G. Felsenthal & Sons, Inc.,** Chicago, Ill., died on February 22.

## Meetings

### Plastics Groups

**April 26-27:** The Society of the Plastics Industry, Inc., Midwest Conference, French Lick Springs Hotel, French Lick Springs, Ind.

**June 11-15:** The Society of the Plastics Industry, Inc., Seventh National Plastics Exposition, New Coliseum, New York, N. Y.

### Other meetings

**April 9-12:** American Management Association, Silver Anniversary National Packaging Exposition, Convention Hall, Atlantic City, N. J.

**April 10-12:** Point-of-Purchase Advertising Institute Inc., Tenth Annual Symposium and Exhibit, Hotel Sheraton-Astor, New York, N. Y.

**April 11-13:** Research and Development Associates, Annual Meeting, to be held at the Statler Hotel, Boston, Mass.

**April 23-28:** Manufacturing Chemists' Association, Inc., Third Annual Chemical Progress Week.

**April 23-May 3:** British Industries Fair, Olympia Hall, London, and Castle Bromwich, Birmingham, England.

**May 6:** American Institute of Chemical Engineers, Meeting, Roosevelt Hotel, New Orleans, La.

**May 7-9:** TAPPI (Technical Assn. of the Pulp and Paper Industry), Seventh Annual Coating Conference, Benjamin Franklin Hotel, Philadelphia, Pa.

**May 15-16:** Chemical Market Research Association, Meeting, Biltmore Hotel, New York, N. Y.

**May 16-18:** Society for Experimental Stress Analysis, Meeting, William Penn Hotel, Pittsburgh, Pa.


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AUTOMATICALLY MOLDED ON THIS
IMPROVED ROTATIONAL CASTING MACHINE
This machine, requiring only one operator, can produce as many as 1620 articles per hour at an obviously low labor cost per article.
It consists of six spindles which revolve around a central shaft. Each spindle carries a multiple cavity mold and has its own rotational movement independent of the central shaft movement. The plastisol goes through the complete progressive stages of gelling, fusing, and cooling into its final resilient form in a variable cycle of 12 to 20 minutes.
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## Machinery and equipment for sale

**NEW ARRIVALS FOR SALE:** French Oil Mill Mchy. Compression Molding Presses, 50-170 tons; 5 Preheaters 2KW; Wood 20"x20" 12" ram 170 tons; Southwark 24"x24" 12" ram, 170 tons; Baldwin Southwark 4-26"x26" 8" rams, 75 tons; 5-26"x26" 7" rams 57.7 tons; 2-15"x15" 8" rams 75 tons; 2-19"x24" 10" ram, 78 tons; 2-12"x12" 7½" rams 66 tons; 2-D&B 12"x12" 7" rams, 57.7 tons; 8"x9" 4½" rams, 24 tons; D&B 12"x12" 3" rams, 10 tons; HPM Transfer Molding 75 tons; Preform Presses, Colton 5½T Stokes R and DDS-2 MD; New Universal Dual Pumping Units 3-15 HP; Laboratory Mills and Calenders; also Extruders, Mixers, Vulcanizers, Injection Molding Units, etc. Universal Hydraulic Machinery Co. Inc., 285 Hudson Street, New York 13.

**FOR SALE:** Hartig, 3¼" Oil Heater Extruder. Stokes 150 ton semi-autom. hydr. Press. Kux 2½" dia. single punch Preform Machine. Leominster 8 oz. Injection Molding Machine. Farrel 15"x36" 2 roll Mill. Mills and Calenders up to 84". New Seco 6"x13" and 8"x16" Lab. Mixing Mills and Calenders. Plastic & Rubber Extruders. Brunswick 225 ton 21"x21" platens. French Oil 8 opening 315 ton 42"x42". Wat.-Stillman 75 ton automatic Molding Press 20"x20" platens. 200 ton Hobbing Press 18"x14" platens. New Loomis 340 ton, 24"x56" platens. D&B 150 ton, 24"x24" platens. Adamson 100 ton, 20"x 20" platens. Farrel 200 ton 20"x80" platens. Southwark 30 ton 14"x14" platens, semi-auto. Also Lab to 2000 tons from 12"x12" to 48"x48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250#. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Pumps, Accumulators. Stokes Automatic Molding Presses. Rotary & single Punch Preform Machines ½" to 4". Injection Molding Machines 1 oz. to 60 oz. Baker Perkins Jacketed Mixers. Plastic Grinders. Heavy duty mixers, gas boilers. Partial listing. We buy your surplus machinery. Stein Equipment Co., 107 8th Street, Brooklyn 15, N. Y. STerling 8-1944.

**FOR SALE:** 1 Kux 35 ton preform machine complete with 5 H.P. motor, sterling variable speed drive, and a good assortment of dies. All in working condition. Specifications: Max. depth of fill 2½". Max. Dia. of fill 2½". Speed strokes/min. 20 to 60. Price complete $1200.00. Reply Box 7015, Modern Plastics.

**FOR SALE:** 1—Royle #4 Extruder, motor driven; 1—6" x 12" Laboratory Mill, m.d.; 1—Ball & Jewell Rotary Cutter, size O m.d.; 2—Baker-Perkins Size 15, 100 gal. Jacketed Mixers; 5—Horizontal Dry Powder ribbon Mixers, 4000#, 1500#, 500#; 1—New 3 Roll 6"x16" Laboratory Calender; 1—Farrell-Birmingham 60" Mill with reduction drive, 150 HP motor, floor level mounting; 1—Fitzpatrick "D" Comminutor, S.S. contact parts, jacketed; 1—Mikro Pulverizer #2th, with motor; 4—Reed-Prentice & W-S Injection Molding Machines, 2-16 oz.; Also other sizes: Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. What have you for sale? Consolidated Products Co., Inc., 50 Bloomfield Street, Hoboken, N.J. HOboken 3-4425, N.Y. Tel.: BArclay 7-0600.

**FOR SALE:** 3—Ball & Jewell #2, #1½ Rotary Cutters; 1—Cumberland #0 Rotary Cutter; 4—Two Roll Mills 20"x22"x60", 15"x40", 6"x14"; 3—Baker Perkins 100 gal. 50 gal., 2 gal., jacketed double arm Mixers; 1—Stokes Rotary Preform Press #DDS2; 3—Stokes Model "R" single punch Preform Presses; 1—Kux Model 15-25 Rotary Press; Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

**FOR SALE:** (11) 75 ton record presses, complete @ $2,450, (11) new 100 ton, 10" ram, 10" stroke @ $1,100, (8) 200 ton, 9" stroke, 14" ram, 36x36 @ $1,850, (7) 200 ton, 9" stroke, 15" ram, 30x30 @ $1,650, (1) 50 ton complete, 18x18 @ $1,850, (1) 200 ton, 16" ram, 30x30 @ $2,450, (2) 200 ton, 16" ram, 42x42 @ $2,850, (1) 200 ton, 15" ram, 42x42 @ $2,450, (4) 250 ton, (2) 12" rams, 30x60 rebuilt @ $3,375. Hydraulic Sal-Press Co., Inc., 388 Warren Street, B'klyn, N. Y.

**AVAILABLE AT BARGAIN PRICES.** W.&P. 200 gal. Jacketed Mixer with sigma blades, tilting type bowl. Baker Perkins 200 gal. Double Arm Mixer with sigma jacketed blades, can be used with and without vacuum dome. J. H. Day from ¾ up to 100 gal., Imperial and Cincinnatus D. A. Jacketed, Sigma Blade Mixers. Day 15 to 10,000 lbs. Dry Powder Mixers. Gemco 2000 lbs. 56 cu. ft. Double Cone Blender. Mikro Bantam, 1SH, 1F, 2TH Pulverizers. Day, Rotex, Tyler Hum-mer, Robinson, Raymond, Gayco, Great Western Sifters. Colton 2RP and 3RP Rotary Tablet Machines. Carver Laboratory 20 ton hydraulic Press. Package Machy. FA, FA2, FA4, Miller, Hayssen, Wrap-King, Scandia, Hudson Sharp, Oliver Auto. Wrappers—all sizes. This is only a partial list. Over 5000 machines in stock available for immediate delivery. Tell us your machinery requirements.
Union Standard Equipment Co.
318-322 Lafayette St.
New York 12, N. Y.

**FOR SALE:** Stainless Steel Rotary Dryer. Link Belt Co., 5'2"x16". No. 502-16, with all auxiliary equipment. Roto louvre also 6'x24' and 5'x26'. Hersey Stainless Steel Rotary Driers. Reply Box 7000, Modern Plastics.

**FOR SALE:** (2) 300 Ton W. S. Presses 20x 20 & 29x24 Platens. 140 Ton W.S. 22x16 Platen. 85 Ton Waterbury Farrel 20x24 Platen. 63 Ton Press 15x15 Platen with Pullback Cyls. 9, 8, 4, Oz. Injection Molding Machines. 15 Ton Lab. Presses 10x8 Platen. 10 Ton Lab. Presses 6x6 Platen. Standard Mystic Embossing Presses, Accumulators, Pumps, Valves. 250 Ton W&S 28x24 Platens, 80 Ton Farrel 24x24 Platens. Many other Presses—Send for Bulletin. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N.Y. Tel.: WAlker 5-8300.

**FOR SALE:** 1½" National Oil Heated Plastic Extruder New '47; nominal cap. 30-35 # per hr; 3 HP Dr; 6-72 RPM speeds; 575° oil temp; w/die head & large quantity of equipment & controls. 8-12-16-22-Oz. HPM, W. Stillman, Reed Prentice, Lester Phoenix Injection Molding Mchnes., 1950 and later. Eveready, 805 Housatonic Ave., Bridgeport, Conn. EDison 4-9471.

**FOR SALE:** One Lester 8 oz. Injection Molding Machine, Model L-2-8, new in 1952, complete with Wheelco controls, etc. Excellent condition. Can be seen in operation. Sterling Plastics Co., 1140 Commerce Ave., Union, N. J.

**FOR SALE:** Injection Molding Machines, 16 oz. 1951 HPM, 12 oz. 1947 W-S, 8 oz. 1946 Lester, 4 oz. 1952 Lester—Die Hobbing Presses 150 ton to 1000 ton. Compression Molding Presses, Pumps, Accumulators, etc. Partial Listing—Many more items—Send us your inquiries. Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N. J., telephone Deerfield 4-1615, cable address "Plasmex, Boonton."

**FOR SALE:** Stokes 280A Preform Press—Preis Engraver Press 80 ton in good condition, 15 HP 220-440, 3½ round die, other dies may be substituted. Weight 15,000 lbs. $1950.00. Engraver Model VE3 with index table, vices, cutter grinder, set of type and numbers. Over $1100.00 value, Like new $650.00. Clay Manufacturing Co., 1929 Opdyke Rd., Pontiac, Michigan. Phone Federal 5-7586.

**FOR SALE.**
#3-oz. Fellows Injection Molding Press, 1953 Model. In splendid condition. Price is $8,000.00.
Moldcraft Products, Inc.
1505 W. 41st Street
Baltimore 11, Maryland

**FOR SALE:** 1—6x12" lab mill, MD; 1—R. D. Wood 30 ton self-contained compression press; 1—Hartig 2" plastic extruder; 1—French Oil Mill 100 ton self-contained transfer press; 2—Cumberland grinders, 5 HP and 20 HP; also mixers, presses, grinders, etc. Chemical & Process Machinery Corp., 52 Ninth St., Brooklyn 15, N. Y.

**FOR SALE:** Plastics manufacturer has for sale one N.R.M. 4½" Extruder complete with oil heat and 40 H.P. drive, together with the following—die for making 52" Polystyrene Sheet; N.R.M. 3 roll haul-off unit with sterling control for heating rolls; and cut off shear. All like new. Reply Box 7022, Modern Plastics.

(*Continued on page 308*)

# Outstanding Opportunities in Plastics Manufacturing

Several positions in plastics and small metal parts manufacturing are open with a well-established manufacturer located in southern New England. The firm is now beginning a major expansion program providing outstanding job opportunities for qualified manufacturing engineers, quality control engineers and foremen.

1) **Quality control supervisor** for plastics operations. Must have previous experience in manufacturing and quality control or have engineering background.

2) **General Foremen** for plastics finishing department. Some previous experience in supervision required.

3) **Foremen** for compression, plunger and injection molding departments in plastics manufacturing.

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One of these positions could mean new opportunities for you. Send us a resume of your education and experience. All material will be held in confidence.

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(Continued from page 306)

**FOR SALE.**
32-ounce HPM Machine, new in 1950, in good operating condition, available for early delivery. Can be seen in operation in our plant in the middle west.
Reply Box 7029, Modern Plastics.

**FOR SALE:** Injection Presses: 4, 8, 12 oz. Reeds. 2, 9, 16 oz. HPM. 32 oz. Vertical HPM. 8, 12 oz. Lester. 4 oz. Lewis. 12 oz. Watson. 1 & 2 oz. Van Dorn. Extruders: 4½" NRM electr. heat. Ovens. 48" Stokes Vacuum Metallizer setup. 6x12" Lab. Mill. Markem Imprint Mach. No 25 A. Compression & Transfer Presses: 50 to 600 Tons. 15 T. Stokes Automatics. Preform presses: Colton 5½ T and 3 Rotary. Auto-Vac 52"x30" Vac. Form. Mach. 200 T. Hobbing Press. 24 & 16 Carrier Braid. Mach.—2 Laminating Presses 18x18" Pl. 4 open.—All Midwest Locations. List your Surplus Equipment with me.—Justin Zenner, 823 Waveland Ave., Chicago 13, Ill.

**FOR SALE:** Foxboro Potentiometer Temperature controller for Electric Oven or any device requiring accurate temperature control. Range zero to 340 Degrees F. 40 Amperes Capacity. An extremely accurate and beautiful instrument in new condition. A bargain for $175.00. Reply Box 7036, Modern Plastics.

**FOR SALE.**
1—Mitts & Merrill, 25 H.P. Vari Speed Pelletizer. Brand new. Not used for over 30 hours. 1—Cumberland Pelletizer with Vari Speed 5 H.P. motor. Excellent condition. About two years old.
Roart Co.
830 Monroe St.,
Hoboken, N. J.

**FOR SALE:** 60 oz. H.P.M. w/1200 ton clamp; 48 oz. Lester; 48 oz. DeMattia; 32 oz. Lester, 1950, $22,000; 32 oz. R-P, 1950, $26,000; 40 oz. H.P M., 1949, $27,000; 16 oz. R-P, 1948, $13,000; 16 oz. Impco, w/10 oz. cyl., $7,500; 16 oz. H.P.M. 1951, $15,000; 16 oz. H.P.M. 1946, $8,000; 12 oz. DeMattia w/16 oz. prepack, fully hyd., 1951/52, $10,000; 12 oz. DeMattia, $7,000, Terms; several 12 oz. Lesters; 8 oz. Reed-Prentice 1952, $9,500; 8 oz. R-P, single link, $3,750; 8 oz. Leominster, $3,750; 9 oz. H.P.M. 1946, $5,000; 9 oz. Monson, $5,500; 6 oz. R-P, $7,000; 8 oz. Reed-Prentice, rebuilt, $7,000; 4 oz. Lester, $3,000; 4 oz. Lester, fully aut., 1953, $8,500; 4 oz. Lester vert., $5,000; 4 oz. Watson-Stillman, $4,000; 4 oz. H.P.M., 1948, $4,500; 4 oz. Impco; 3 oz. Fellows, 1953, $8,000; 3 oz. Fellows 1951, $5,500; 2 oz. semi-aut. Van Dorn, lever type, $2,000; 2 oz. Moslos, 1954; Stokes presses, all types; DeMattias, horiz. & vert.; Italian extruders, granulators, Ovens; Let us list your surplus equipment. Acme Machinery & Mfg. Co., 102 Grove St., Worcester, Mass.

**FOR SALE:** Vacuum forming machine—double table 24x42, complete with all controls. Also, Mogul model F10 metal spraying equipment for mold making. Also, industrial solvent drying oven, electric, 30x52x48 I.D., with six racks. Also, twelve vacuum forming molds for flexible heavy vinyl sheets, in various designs @ $100.00 each. The Empire Curtain Company, 4077 Park Avenue, New York 57, N. Y.

**FOR SALE:** Heavy Duty Double Arm Sigma Blade Mixers. (3) Readco 50 gal. 30 HP; (2) W & P 100 gal; (1) Banbury #3 with 75 HP motor. (2) Kux Rotary Pellet Presses. (4) Sprout-Waldron Horizontal Ribbon Mixers 336 cu. ft. (12,000#) capacity. (1) St. St. Pug Mill 7" dia. x 3'9" long overlapping chambers, jacketed 75#. (4) Mikro Pulverizers #2DH, #2TH, #3TH. (3) Fitzpatrick Stainless Steel Comminuting Machines, Models D, K & F. We buy your surplus equipment. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

**FOR SALE:** Hydraulic Presses: R. D. Wood 2500 Ton, 8-Opening, 84"x54" Steam Platens. R. D. Wood 2500 Ton, Single Opening, Down-Acting, 92"x204" Bed. Elmes 1000 Ton Hobbing, M. D. Pump. Birdsboro 882 Ton, Down-Acting, 48"x48" Bed. Self-Contained. HPM 750 Ton, Down-Acting, 59"x44" Bed, Self-Contained. Farrel 625 Ton, 52x52" Platens, Self-Contained. Watson-Stillman 600 Ton, Hobbing, M.D. Pump. Farrel 393 Ton, 2-Opening, 48"x48" Steam Platens. Elmes 350 Ton, Down-Acting, 30"x36" Bed, Self-Contained. Lake Erie, 215 Ton, 36"x36" Platens, Self-Contained, Semi-Automatic. Carey 150 Ton, 21"x16" Platen, Adj. DLO 8"-28" (3). Farquhar 100 Ton, Down-Acting, 30"x28" Bed, Self-Contained. Farquhar 100 Ton, Drawing, Down-Acting, 29"x34" Bed, High-Speed. Self-Cont. Watson-Stillman 100 Ton, Down-Acting, 22"x20" Bed, Self-Contained. Watson-Stillman 100 Ton, Burroughs 75 Ton, HPM 35 Ton Molding Presses. Watson-Stillman and Elmes 30 Ton and 20 Ton Lab Presses. Stokes Model 200D-2, 15 Ton Automatic and Stokes 300, 200, 150 and 100 Ton Semi-Automatic Molding Presses, All Self-Contained. Injection Machines: De Mattia, Model B, 24 oz. HPM, Model 350-H-16, 16 oz. Reed-Prentice, 12 Oz., 1952 Machine. HPM 200-H-9, 9 Oz. (2). Reed-Prentice, 8 Oz. Impco, 8 Oz. Vertical, Late Model. Watson-Stillman, 2 Oz. Van Dorn, Model H-200, 1 oz. and 2 oz. Tablet Machines: Stokes S-5, RD-4, RDS-3, R and T; Colton #5½, #5, #2-RP and #3-RP, Kux 64. Extruders: Royle Nos. 1, 3 and 4; Allen-Williams 8"—All Individual Motor Drive. Mills: Farrel 18"x50" (4); Farrel 16"x40" (4); Farrel 15"x36" (2)—Available as Mill Lines or as Individual Units. Rotary Cutters: Cumberland No. 0, 2 HP M. D., Ball & Jewell 1 HP M. D., Stainless and Plain. Miscellaneous: Vulcanizers, Grinders, Pumps, Valves, Platens, Etc. Johnson Machinery Company, 683-P Frelinghuysen Avenue, Newark 5, New Jersey. Bigelow 8-2500. What Have You for Sale? What Are You Looking For?

## Machinery and equipment wanted

**WANTED:** Following used equipment to establish Plant in Canada. 1—3-4 colour flexographic Printing Press. 1—Roto Bag Poly Machine. 1—Simplex Poly Machine. 1—Simplex Cellophane Machine. 1—Sheeter—with electric eye. 1—Slitter—30-40" width. 1—Roto Bag Holweg Machine. Would buy complete Plant. Above equipment must be in good working condition. Reply Box 7038, Modern Plastics.

**WANTED:** RD3, RD4, RDS3 Stokes Preform Presses. Button Inspection Belts. 4 oz. Reeds or Others. Button Molds, Compression & Injection. Reply Box 7035, Modern Plastics.

**WANTED:** Injection Moulding Machine. Capacity 8 or 10 oz. Give details. Hechler Brothers Inc., 22-19 37th Avenue, Long Island City 1, N. Y.

**WANTED:** Used first class top condition Lester 12 oz. Injection Machine. Need immediately. State Condition, age, serial number, best price. Reply Box 7006, Modern Plastics.

**LABORATORY MILL WANTED:** 6"x12", also other plastics and resins laboratory and pilot plant equipment. Skeist Laboratories, 89 Lincoln Park, Newark 5, New Jersey. MArket 3-5002.

## Materials for sale

**VINYL COMPOUNDS:** 40,000 lbs. Opaque Green hose compound, 20,000 lbs. window spline compound. Prices very reasonable. Write The Blane Corporation, Canton, Mass.

**FOR SALE.**
3,000 lbs. Virgin standard Yellow Tenite I; 7,000 lbs. Virgin Transparent Pink Acetate; 12,000 lbs. Virgin Green and Lt. Blue High Impact; 18,000 lbs. reprocessed Red High Impact; 20,000 lbs. Natural and Colors C-11; 15,000 lbs. Bright Colors Polyethylene; 30,000 lbs. Transparent Red Methyl Methacrylate Taillight formulation; 18,000 lbs. Black Butyrate; 50,000 lbs. rigid solid and mixed colors Vinyl; 50,000 lbs. Reground Soft Mixed colored Vinyl. Samples and prices on request.
A. Bamberger Corporation
703 Bedford Ave.,
Brooklyn 6, N. Y.
Telephone MAin 5-7450.

**FOR SALE:** 40,000 lbs. 150/1/2 Vinyl Coated Glass Yarn (Seconds). Usable as a reinforcement for laminates and other industrial uses. Reply to: Chemo-Textiles, Inc., P. O. Box 169, West Warwick, R. I.

**FOR SALE:** 50,000 lbs. A-1 Top Grade Reprocessed Black Butyrate granules. Also 60,000 lbs. finest quality utility black high impact polystyrene granules. Both can be used in high quality production. Let us know your quantity requirements, and we will send samples and prices immediately. Marian Plastics, Inc., 21 Central Street, Leominster, Mass. LE 4-8265.

**PLASTICIZERS:** 20,000 lbs. DIOP prime quality in drums, very low price. Also 10,000 DOP, 5,000 DiButyl, 10,000 DiCapryl, 20,000 DiMethyl Phthalates & 10,000 TCP. Let us know your requirements. Small orders shipped from stock. Chemical Affiliates, Inc., 274 Madison Ave., New York 16, N. Y. Tel.: MU-3-4731

## Materials wanted

**WANTED.**
Plastics Scrap and Rejects of all kinds, Ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid.
A. Bamberger Corporation
703 Bedford Ave., Brooklyn 6, N. Y.
MAin 5-7450

**SCRAP PLASTICS:** All forms, waste and surplus plastic molding materials, rejects in any form. We will also buy your obsolete inventories of molding powders, stabilizers, plasticizers and other plastic and chemical materials. Industrial Surplus & By-Products Co., division of Aceto Chemical Co., Inc., 40-40A Lawrence St., Flushing 54, N. Y. INdependence 1-4100.

**WANTED:** Plexiglas and Lucite scrap, salvage and cut-offs, any quantity. Turn your surplus sheet stock into cash. Ask for our quotation. Duke Plastics Corp., 584 Broadway, Bklyn 6, N. Y. Evergreen 8-5520.

**PLASTIC SCRAP:** Polystyrene, Hi Impact Polystyrene, Polyethylene and Acetate. Top Prices Paid. Plastic Moulding Powders, Inc., 2004 McDonald Ave., B'klyn 23, N. Y. ES 5-7943.

**PLASTIC ROD ITEM:** 42" long, ¾" to 1" cross section. Section may be circular, triangular or any shape; can be solid, tubular or formed from sheets with bottom side open. Material must be odorless, non-porous and withstand continuous 250 degree F. without warpage or shape distortion; resistant to alkali and weak acid detergents. Rod must support 25 lbs. distributed over total length with maximum ¼" sag. Plastic Must Pass Government Inspection For Contact With Perishable Foodstuffs! Can use 100,000 in 1956 and quarter million annually after. Dahl Woodwork and Plastic Laminates, 1408 Germantown Ave., Philadelphia 22, Pa.

**WANTED:** Plastic Scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 601 West 26th Street, New York 1, N. Y.

**MATERIALS WANTED:** Lucite and Plexiglas Scrap and cut-offs. Also Styrene, Acetate, Butyrate scrap and surplus molding compounds from vacuum forming and injection molding operations. We buy any quantity at top market prices. Claude P. Bamberger, Inc., 152 Centre Street, Brooklyn 31, New York, Tel.: MAin 5-5553. Not connected with any other firm of similar name.

**ATTENTION BUYERS:** Always a dependable service to the trade. We pay the best prices. Dealers in sheets, salvage and scrap. We will buy and sell scrap, salvage and cut-offs. Write at once! Salvage a specialty. No quantity too small or too large. Dealers in domestic and export. For the best deal see Eastern Plastics, 89 Atlantic Avenue, Brooklyn 1, N. Y.

**POLYSTYRENE SCRAP WANTED.**
Top Prices paid for all forms of Polystyrene scrap. Reground, sheet, molded pieces, etc. Any quantity. For quick action phone or write:
Marian Plastics, Inc.
21 Central Street
Leominster, Massachusetts
LE 4-8265

## Molds for sale

**FOR SALE:** Complete line of Houseware Molds, Comb Molds, also some novelty and specialty items. No reasonable offer refused. Send for list. Reply Box 7034, Modern Plastics.

**FOR SALE:** Six sets of steel molds for original and attractive plastic toys. A once-in-a-lifetime bargain for an established plastic toy manufacturer, or a rare opportunity for an easy and economical start for some one just entering the toy manufacturing field. Reply Box 7024, Modern Plastics.

## Plants for sale

**PLANT FOR SALE.**
Fiber glass reinforced plastics division of Southern plastics company. Tooling and complete nationwide distribution on the nationally famous Gladwin Plasti-Hamper. Plant includes three 100 ton presses, one 50 ton press, 1 flat bed press, 1 preform machine and oven, miscellaneous mixers, 1 new Brenner roving cutter, 2 proprietory item molds, other usual accessories. Write or wire:
Ralph F. Chambers, Gladwin Plastics, 275 Houston Street, Atlanta, Ga.
Telephone Alpine 5384.

**VACUUM MOLDING PLANT FOR SALE:** Unusual opportunity to purchase a complete business, not including real estate. Major equipment consists of three dual bed semi-automatic vacuum molding machines, the largest having an effective molding area of 4'x8'. The smallest machine molds 30"x50". Large centralized vacuum system complete with master control panels and all electronic instrumentation mounted. Sale includes all types of finishing equipment too numerous to list. Special double end tenator for sawing out large panels. New Wales Strippet 30 ton punch press. Various assorted other presses, television mask center routers; all types of special bevelers, routers, carbide tipped saws, jigs, fixtures, air cylinders. All equipment is in excellent condition and is currently operating. All of the above listed machinery is flexible, tried and proven. All Vacuum Molding machines will operate both with and without drapes; all have ground platens, must be run to be appreciated. Reply Box 7032, Modern Plastics.

## Help wanted

**PLASTIC SALES ENGINEER:** We are seeking a well qualified man experienced in plastics extrusion for attractive Market Development position. Kindly give your education, experience, and expected salary in complete resume. All replies will receive careful attention and will be held confidential. Write: 108 Personnel Department, Chemical Division, Koppers Company, Pittsburgh 19, Pa.

**INJECTION MOLDING PLANT SUPT.**
Wanted: To take full charge of all plant operations with three machines. Write in detail.
Reply Box 7028, Modern Plastics.

**POSITION OPEN:** A newly formed organization, which will manufacture and fabricate styrofoam and exploded polystyrene refrigerator components, seeks the services of a person experienced in the technology of this new field. Excellent chance for advancement. Please reply to P. O. Box 494, Dayton 1, Ohio, American Plastics, Inc.

**DEVP. AND SALES OPPORTUNITY.**
In broad new field. 3 to 5 yrs. experience in latex and rubber foams with some cushionary experience essential. Salary high—Location, New York area. Send resume.
Reply Box 7005, Modern Plastics.

**ENGINEER:** To take over and manage tetrafluoroethylene (Teflon) fabrication (molding, extrusion, etc.) department of small company which has recently entered that field. Some pertinent experience desirable. Opportunity excellent for intelligent versatile person. Pennsylvania. Reply giving full details including salary desired to Box 7030, Modern Plastics.

**DO YOU WANT TO LIVE** in Sunny California **where the climate is ideal all year 'round? We need experienced Tooling Engineers, Plastic Mold Designers, Tool & Die Makers, Injection Molders and Compression Molders. Write, wire or call Eldon Manufacturing Company, 1010 East 62nd Street, Los Angeles 1, California.**

**CHEMISTS AND CHEMICAL ENGRS.**
**For product development in plastics field. Outstanding opportunity to join recently formed Product Development Department of the Atlas Powder Company, located in Wilmington, Delaware. 5-10 years experience in polymers and their application uses required. All responses held confidential. Direct all replies, marked personal to,**
**R. L. Herrman**
**Atlas Powder Company**
**Wilmington, Delaware**

**PLASTICS EXTRUSION OPERATOR & Ass't Extrusion Foreman:** Wanted by progressive New York City firm. Pleasant working conditions, chance for advancement unlimited by "seniority" and other restrictions. Excellent opportunity for right man—applications treated with strictest confidence. Write, giving full details to: President, Box 7020, Modern Plastics.

**WANTED:** Plastic Production Engineer—Ohio Company now in laminated plastics requires a man with experience in product, process and production of laminating plastic sheets. Should have some experience as experimenter and education or previous experience working in vinyl chemical engineering or in production engineering. Position available preclude to General Works Manager of two plants. Excellent opportunity for a man willing to work and prove results. Good starting salary. Excellent working conditions. Both plants and equipment new. Send resume and salary requirements to Box 7026, Modern Plastics.

**INJECTION MOLD DESIGNER.**
With two to three years' experience and the ability to take advantage of the vast opportunities for advancement in our rapidly growing plastics division. He must be able to adapt present molds and create new ones of intricate and complex design, make minor design changes to permit the manufacture of items on existing equipment, calculate cavities per mold, operating speeds, finishing operations, design articles for injection molding, and handle product inquiries. He will instruct, direct and check work of draftsmen. ME or two years of college training with ample experience. Write:
Director:
Selection of Specialized Personnel,
Owens-Illinois,
P.O. Box 1035, Toledo 1, Ohio.

**PLASTIC SALESMAN WANTED** by Chicago area Custom Injection Molder. **We are in the process of expanding and have a newly created position for the right man with proven background of accomplishment in Sales. Opportunity to become Sales Manager with executive capacity. Salary plus commission. Reply Box 7003, Modern Plastics.**

**PLASTICS SALES ENGINEER:** One of largest Eastern injection molders servicing New England, New York, New Jersey and Pennsylvania seeks Engineer with selling experience for greater New York territory. Write giving full particulars in first letter. Reply Box 7009, Modern Plastics.

**OPP. IN PLASTICS EXTRUSION.**
Production and Development: Long established company in Eastern Massachusetts, diversifying in plastics, needs young competent extrusion engineer to assume responsibility for production and product development. Experience in the extrusion of various plastics required and knowledge of raw materials essential. This is an excellent opportunity for future growth. Please send letter with full details of training, experience, and salary expected.
Reply Box 7023, Modern Plastics.

**HELP WANTED:** Plastic Engineer and Extrusion Operator: West Coast Company expanding plastics division. Engineer must be qualified in die design, estimating, and product and process development in extrusion and injection molding. Unlimited opportunity for right man in our new plastics division. Also have immediate need for experienced extrusion machine operator. Must be familiar with extrusion operation and set up techniques. Good opportunity for advancement for ambitious man. Chance to get in on ground floor with progressive company. State full particulars including experience, age, marital status, salary required, availability. Reply Box 7014, Modern Plastics.

**VINYL CHEMIST:** Leading flooring manufacturer in New Jersey has opening for chemist with experience in compounding and factory processing of vinyl resin. Experience in flooring preferred but not essential. Excellent opportunity for right man. Write giving details of education, experience and salary requirement. All replies confidential. Our employees know of this ad. Reply Box 7042, Modern Plastics.

**HELP WANTED.**
Maintenance Man, familiar with Watson-Stillman and H.P.M. injection molding presses. Particularly interested in man who knows pump and valve troubles and knows how to trace through to locate operating difficulties. Good opportunity with well established, growing organization located in the Southwest. Send full particulars regarding your experience, desired starting rate, and recent snapshot.
Reply Box 7044, Modern Plastics.

**MECHANICAL ENGINEER:** Aggressive man, 30 to 45 years of age. Experience in production, industrial, and equipment engineering essential. To work in developing automatic processing of materials. Background in polyester, phenolic, and melamine molding compounding helpful. Reply Box 7001, Modern Plastics.

**ASSISTANT PLANT ENGINEER:** Permanent position for graduate mechanical engineer with some experience in rubber industry. To assist plant engineer in various phases of project engineering, maintenance, etc. A permanent career with a leading, well established rubber company, in New Jersey. Write giving details of education, experience, and salary required. All replies confidential. Our employees know of this ad. Reply Box 7043, Modern Plastics.

**PLANT MANAGER FOR PUERTO RICO:** Impressive immediate earnings plus an assured future await the experienced executive who can qualify as manager of modern, soundly financed plant in San Juan specializing in production of Polyethylene lay-flat tubing and the converting of all types of plastics and cellulosic films. Excellent starting salary, liberal bonus arrangement, stock option. Living quarters provided. Write in complete confidence outlining qualifications, experience and age. Reply Box 7049, Modern Plastics.

## Situations wanted

**PLASTICS ENGINEER:** B.Ch.E., M. S., Available for position as assistant plant manager, or manager if small plant. Four years diversified experience in responsible positions with major chemical and plastics raw materials company. Development of extruders, operation of thermo-plastic polymers, organics plants. Polystyrene, vinyls, polyesters. Plant supervisor, process development, report writing, economics, cost estimates. Honor societies, patents, papers. New York metropolitan area preferred. Reply Box 7046, Modern Plastics.

**MOLDMAKER-TOOLMAKER:** 18 years experience. Tool design for injection molding. Owner of several U. S. Patents—interested in settling in South America. Will answer all replies. Reply Box 7013, Modern Plastics.

**PLASTICS FOREMAN:** 15 years experience as general foreman of leading injection molding firm in midwest. Will relocate. W. Deardorf, Box 318, Henderson, Ky. Phone: 2221.

**UNIVERSITY PROFESSOR:** Industrial and academic experience in high polymers, publications and patents, active research program in progress, available one or two days per month for consulting. Reply Box 7040, Modern Plastics.

**PLANT MANAGEMENT:** Ten years experience. Production, Planning, Supervision, Maintenance, Product Development. Background in Thermoplastics and Rubber. Compounding, Color Matching, Quality Control. Knows Mills, Banbury, Extrusion Compounding, Calendering, Spreading. Administrative experience in Production and Sales, Technical Representation, Personnel. Cost Minded, Progressive, able to work with others and not step on them. B.S. Thirty Four years old. Reply Box 7008, Modern Plastics.

**EXECUTIVE:** Desires association with company where management, imagination and creative ability are in demand. Accustomed to work at administrative and policy making level. Heavy and diversified experience includes technical production, sales and new product development of coated and laminated Plastics, Films, Foils, Paper, Textiles, Etc. Have 25 years of background to enable a company to enter, expand, and diversify production and sales in these fields. Well acquainted with equipment required to use adhesives, plastisols, coatings, waxes, etc. Will be an asset to company where practical, broad and intimate knowledge is essential and desired. Reply Box 7045, Modern Plastics.

**EXTRUSION SPECIALIST:** With 12 years experience in film, rods, tubes, profiles and sheeting. Working knowledge of all thermoplastics. Background experience includes process development and engineering, production and supervision, die design, production control and new plant installations. Presently production executive in large film extrusion plant. Seeking position with progressive company. Reply Box 7019, Modern Plastics.

**PLASTICS ENGINEER:** 15 years heavy experience with top manufacturers and molders. Thorough knowledge of mold construction and mold design with extensive experience in mold procurement, injection molding machines and materials. Good supervisory background, college graduate, 42 years, married. Seeks opportunity with progressive firm. Reply Box 7037, Modern Plastics.

**OUTSTANDING PLASTICS CHEMIST:** Internationally known research and development chemist with 28 years of intensive work in field of resins, plasticizers, and organic solvents. An able administrator and organizer, was a founder of Czechoslovak Plastics Institute where he headed section on cellulosics. Has also planned, supervised and/or installed plastics research and development laboratories for resin manufacturers, molding and laminating plants, and leading "end-user" firms in U. S., South America, and Europe. Has supervised pilot plant production of phenolics, alkyds, ureas, coatings and varnishes. Is a recognized expert on subject of dielectric applications of resins and plastics. Seeks responsible post that offers challenge of major research and development work. Reply Box 7048, Modern Plastics.

## Sales agents wanted

**MANUFACTURERS REPRESENTATIVE:** Wanted by Chicago area Custom Injection Molder. Modern plant with tool room. Molding capacity up to 16 oz. with facilities for finishing molded parts. Commission basis. Most territories open. Reply Box 7002, Modern Plastics.

**MANUFACTURERS REPRESENTATIVE:** Wanted by the pioneer in extruded plastics for custom extrusion sales in Chicago, New York, Philadelphia, Detroit, Birmingham and Baltimore areas. Exclusive territories open, excellent potential, well known company. These openings are made possible by recent regrouping of custom extrusion sales department. Give present lines and areas covered together with resume of experience in first letter. Reply Box 7033, Modern Plastics.

**SALES REPRESENTATIVE** calling on electronic and industrial parts manufacturers to represent custom molder specializing in precision miniature injection molded parts of nylon and other thermoplastic materials. Commission basis. Reply stating territory covered, age and present lines. Reply Box 7012, Modern Plastics.

**SEEKING MFRS. REP. FOR TEFLON:** Custom molders of Teflon (fluorocarbon plastic) is seeking a wide awake manufacturer's representative in key areas to sell to Aviation, Automotive, Hydraulic and related industries. Company is small but progressive; operating under patent applied for process and is a subsidiary of an established and reliable firm. Here is an outstanding opportunity to work with a product and concern that has a great potential. Reply Box 7021, Modern Plastics.

**MANUFACTURER'S REPRESENTATIVES:** Custom plastics electronic parts fabrication. Expanding Eastern custom fabricators and machinists (automatic screw) of plastics parts—stampings, terminal board assemblies, connectors, insulation—from Teflon, Rexolite, Nylon, laminated phenolics, etc. Need reps with active contacts and experience in electronics industry. Attractive commissions—protected territories. Send data on experience and territories. Reply Box 7047, Modern Plastics.

## Miscellaneous

**PLASTIC TOY HAND ORGAN:** There is nothing like it on the market. I have a working model that plays all the tones including bass, and is very loud and clear. Will demonstrate or send a photo. Seeking future quantity orders or contract. What is your proposition? Charles Feltman, 1434 Fernwood Ave., Lakewood, New Jersey.

**SMALL INJECTION MOLDING PLANT WANTED:** We have an item that should keep your plant busy. We would want 50 percent ownership, with privilege of paying our share out of earnings. We are manufacturers (not plastics) for thirty years. Please give full details, type of equipment and your valuation of plant. Number of years established and length of experience in plastics molding. Reply Box 7007, Modern Plastics.

**NEW ENGLAND COVERAGE:** Aggressive, experienced Manufacturers Representative organization actively associated with the plastic industry since 1929, can accommodate an additional line of raw material, equipment or kindred product. Exclusive basis only. Reply Box 7010, Modern Plastics.

**PLASTIC PLANT WANTED:** Prefer operation with two or three 16 ounce Watson-Stillman Injection Machines. Located Southeastern United States, preferably Virginia or Carolinas. Reply Box 7011, Modern Plastics.

**SWITZERLAND** Manufacturers Representative wants to represent first class American concerns for the sale of their products in Switzerland. We have been selling for over ten years to the Reinforced Plastics Industry, the Electrical and Packaging Industry. Reply Box 7017, Modern Plastics.

**INJECTION MOLDER** wishes to buy molds for plastic dishpans, basins, baby baths, waste baskets, pails, buckets and other large items. Reply Box 7016, Modern Plastics.

**EXPORTING TO SWITZERLAND:** Swiss import firm with plenty of initiative is looking for a tie-up with manufacturers of plastic articles who want to sell their products in the Swiss market. Managing Director will be in U.S.A. from April 16th to 30th. Write: Mr. Henry Muller, Member Swiss Advertising Tour, Hotel New Yorker, 34th Street at 8 Ave., New York 1, N. Y.

**PLASTIC CONSULTANT** desires to enter the manufacturing field, seeking a business connection. Experienced in all phases including technical service, research and development, molding, extrusion, casting, coating and others. Also have wide machine design and construction experience. Reply Box 7025, Modern Plastics.

**CUSTOM MOLDERS WANTED:** Injection-Compression-Extrusion—who have products they desire to sell to the consumer, and need efficient distribution. We are a National Sales Organization selling to Wholesalers, Chains, Dept. Stores, Mail Order Houses, etc., who will completely manage your sales of consumer products on a straight commission basis. Complete promotion, merchandising, correspondence and all sales problems handled by us. Reply Box 7041, Modern Plastics.

**ESTABLISHED IMPORTER** of brush materials is interested in adding a line of synthetic fibres for brush filaments. Reply Box 7039, Modern Plastics.

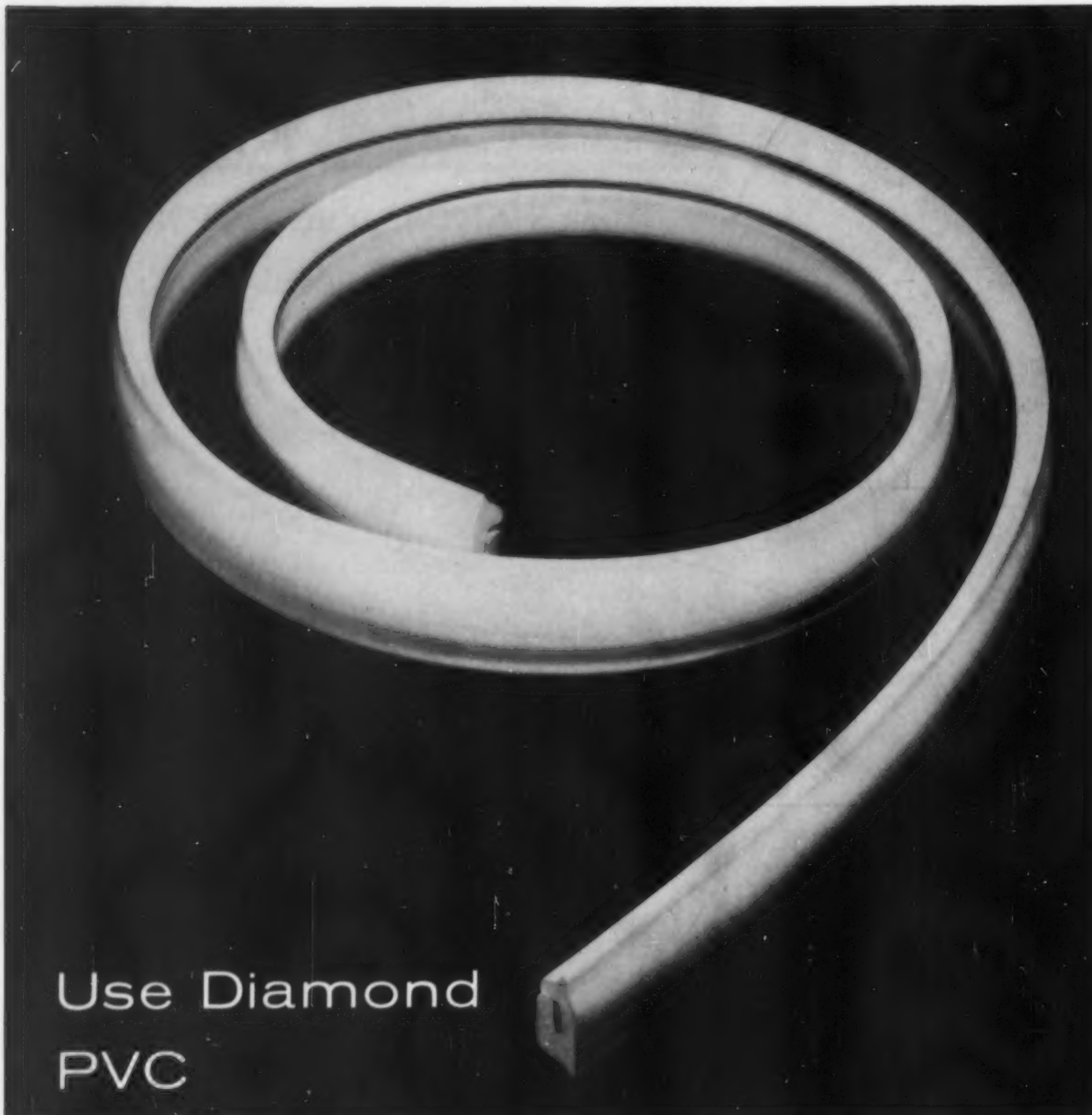
**MOLDS WANTED:** Wish to purchase molds for 8 oz. and 12 oz. machines. Mention or send illustration of item, number of cavities on mold and weight of piece. Also interested in obsolete Industrial items. Reply Box 7018, Modern Plastics.

# Index of Advertisers

April 1956

Modern Plastics, 575 Madison Avenue, New York 22, N. Y.






# for Uniform Color and Clarity

CHEMICAL PROGRESS WEEK-APRIL 23-28

This high-quality extrusion is typical of many types which are economically produced with DIAMOND PVC. DIAMOND resins have good heat stability and absorb plasticizers readily to produce free flowing dry blends.

Both DIAMOND resins, PVC-50 and PVC-45, fuse rapidly in molding, extrusion and calendering operations. They produce products with good color, clarity and gloss.

DIAMOND PVC-50 is especially suited for electrical insulation; has Underwriters' Laboratory acceptance. PVC-45 is designed to meet lower temperature processing requirements.

For information on DIAMOND PVC resins and technical cooperation on your processing problems, write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS

**Diamond Chemicals**